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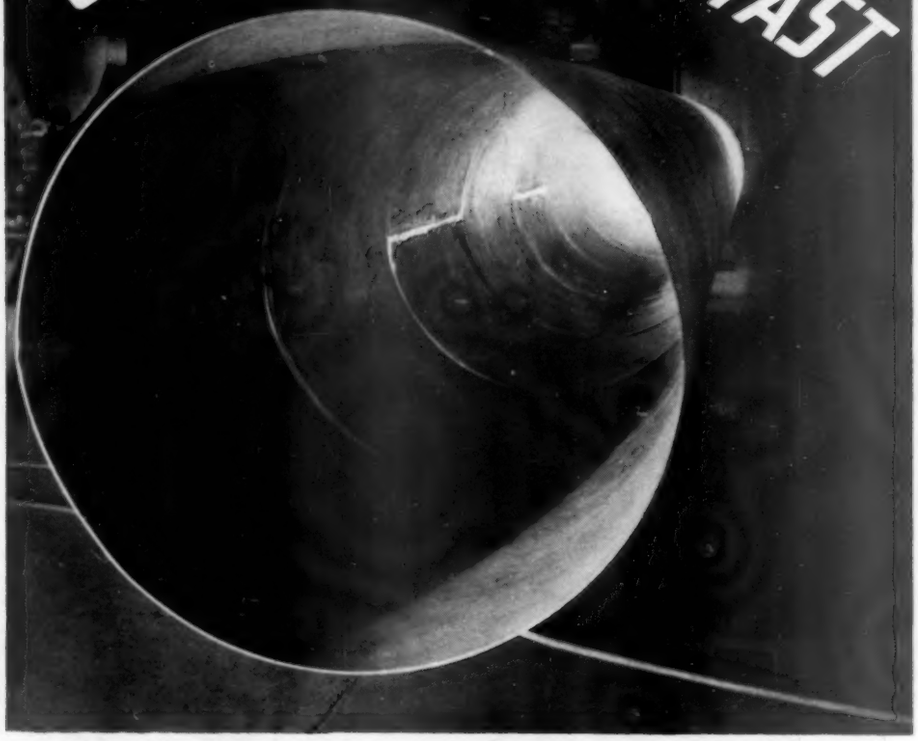
ctober, 1934 Number 10

oneer Business and Technical Journal of the Welding Industry

315,000 POUNDS OF PLYKROME

to keep air moving—FAST



● A section of the five-foot air duct for the Milwaukee Sewage Disposal Plant . . . five feet in diameter . . . with a total length of 1800 feet. One-quarter inch Plykrome is the material.

ONE of Plykrome's advantages is the smoothness of its stainless surface . . . a coefficient of friction so low as to present little resistance to the passage of air, gases or liquids under pressure. Another advantage is the resistance of its stainless steel surface to corrosion over long periods of time. A third is the facility with which it fabricates.

This combination of qualities led to the adoption of Plykrome for a giant air duct in Milwaukee's Sewage Disposal Plant. 315,000 pounds of one-quarter inch Plykrome is being fabricated into an 1800-foot pipe line ranging up to five feet in diameter.

The entire installation is being fabricated by arc welding . . . speedily and economically. Once installed its resistance to corrosive action will assure efficiency without maintenance or replacement.

For any installation in which corrosion resistance on one side is enough and where cost saving is a factor, it will pay you to investigate Plykrome. Full information will be sent on request.

USS PLYKROME

U S S CHROMIUM-NICKEL ALLOY STEELS ARE PRODUCED UNDER LICENSES OF THE CHEMICAL FOUNDATION, INC., NEW YORK, AND FRIED. KRUPP A. G. OF GERMANY

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SUBSIDIARY OF UNITED STATES STEEL CORPORATION

MEMBER AUDIT BUREAU OF CIRCULATIONS

THE WELDING ENGINEER

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OCTOBER, 1934

Vol. 19, No. 10

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· E D I T O R I A L ·

Developments in Control Create Wider Use for Welding

• Automatic electric control is assuming greater and greater importance in the field of arc and resistance welding. Recent important developments in the field of welding are in large measure the result of improved schemes and devices for the automatic control of electric circuits. ¶ Modern control equipment ranges all the way from simple manually operated starting switches for motor-generator sets or a.c. transformers, to large panels carrying intricate equipment for cycle resistance welding. In view of the complexity of many controls and the severe service to which they are subjected, the marvel is that the contactors and relays, with their infinite variety of parts, when called upon to perform their functions under any and all manner of service conditions, do their stuff like actors in a well rehearsed play, with hardly any attention on the part of the maintenance crew. ¶ It was not many years ago when the knife switch and fuses were the conventional means for starting motors and protecting them against overload currents. The developments in control since that time have been astounding. Yet this important chapter in the annals of industrial progress is but little known outside of its immediate field. Those responsible for the development of this science have done a work of which they can well be proud. ¶ Present-day devices open and close electric circuits, responsive to the touch of a hand or to physical changes of media under control, and give sure protection against damaging overload currents without causing undue delay by premature action. No longer must the workman expose himself to the hazard of live switch parts; his control panels are completely enclosed, and they can be locked to prevent tampering. No longer is he required to replace fuse after fuse, or fall to the temptation to bridge fuse clips with nails or copper coins, when a heavy load taxes the motor to its utmost; for now his starter has overload relays which do not trip until the motor windings have become dangerously hot. Hence harmless momentary overload currents do not trip out the switch, and the relay, after tripping, is reset by pushing a button or operating a simple little lever. Overload protection is now really protection and not an expensive makeshift that causes fuses to be blown while the motor is still cool. Also, with recent developments in contactor design, automatic starters of today take up less space than the old-time knife switch and fuses of the same rating, and maintenance costs are less—to say nothing of their greater safety to operators and workmen. ¶ The use of control equipment in welding operations, originally limited to the opening and closing of circuits to a.c. transformer equipment and motor-generator sets, has expanded to include tube controls for resistance welding machines, remote-control devices responsive to the arc-welding operator, and automatic disconnect switches to reduce the secondary voltage of arc-welding transformers when the arc is extinguished. Recent developments have broadened the field of welding by adding to the convenience of the art, by increasing the "use factor" of welding equipment, by supplying the exact amount of heat in a resistance weld to insure fusion without burning, and by reducing the time of current passage in spot and seam welding so that undesirable metallurgical changes superinduced by heat are largely reduced or eliminated altogether. ¶ In the field of arc welding, convenience and comfort are recognized as allies of good welds. The operator who can control his heat from his station is apt to change his heat to suit the work in hand. If he has to make a trip to the machine to make such adjustments, there is a temptation to get along with the heat at hand, even though his work suffers. The operator using an arc-welding transformer feels more at ease if he knows that a few seconds after withdrawing his electrode the maximum potential between the electrode and the work is reduced to a safe figure, eliminating danger of shock. ¶ In the field of resistance welding, automatic control gives the production department assurance that the novice at the machine is obtaining good, sound welds, if the machine beforehand has been set for the proper heat. Moreover, cycle welding, which can be obtained only with automatic control, cuts the time of current flow down to an extremely small fraction of a second, so the fusion zone is limited to a spot or line between the sheets and does not extend to the outer surface of either the upper or lower sheet; hence, the surface metal is not exposed to fusion heat and adverse metallurigal changes do not take place in the surface metal. In designing control for resistance welding machines to operate in 1/60th or 1/120th of a second, the control engineer was confronted with the problem of finding other means than moving contacts to effect this control, since the inertia of the switch parts make such devices impracticable. The problem was solved by taking advantage of the fact that the "inertia" of an electric circuit can be overcome in a fraction of the time and with a much greater accuracy of the timing period, than can the inertia of a moving switch. Hence a reactance winding of high sensitivity was used to replace the switch, and the rest of the problem presented no insuperable obstacles. ¶ The manufacturers of control equipment have kept apace of progress in welding machinery. To their credit it can be said that they have achieved a high degree of reliability in the functioning of control units, and this in no small measure has contributed to the rapid advancement of the art of welding.

AN ADVERTISEMENT FOR NICKEL-BEARING WELDING RODS MANUFACTURED BY THE INTERNATIONAL NICKEL COMPANY

"I Cover The WELDING Front ... also its Back, Top and Sides!"

NICK RODDER

A group of four, 250 gallon Pure Nickel steam jacketed kettles. This group represents the first shipment on an order of eight. Mfd. by Lee Metal Products Co., Phillipsburg, Pa.

SOME of my jobs are all 'round ones . . . like boilers, tanks, and kettles. It's a poor day that the office doesn't get a phone call or a telegram saying, "Where the heck is Nick? We've got a job even that laddybuck can't handle," or words to such effect.

The boss grins and says, "Roll up your overalls, Nick." And I roll.

Last time they pulled this "Couldn't be done" line on me was a tough one: a boiler 20" in diameter with standard flanged and dished heads; top convex and bottom concave. The longitudinal seam was welded on the automatic resistance welder.

The job is made of 14 gauge Monel Metal sheet, 50,000 pounds p. s. i. minimum yield point metal, and the boiler has to pass a 300 pounds p. s. i. pressure test.

Because of the convex head, it's not in the cards to join it by automatic seam welding. So I spot weld it at five convenient points around the circumference. Then I gas weld the top edge of the body to the head using Inco Gas Welding Flux to improve the flow of metal and to keep down the cost of polishing later on. The rod is 3/32" Monel Gas Welding Rod.

We seam weld the bottom concave head, silver solder in the spuds and send her off to the inspector. She never comes back, so at quitting time I buy the boys a drink down at a Dutchman's named O'Brien and catch the Cannon Ball home.

☼ ☼ ☼

Another job I had last week was a flock of pure Nickel steam jacketed kettles for a preserve manufacturer. The kind of job any fabricator loves: eight 250-gallon babies made out of 1/8" and 3/16" Nickel sheet, gas welded.

First, I talked with the welders on the job. They're fine, upstanding lads like you usually find at the business end of a gas line. I took some pieces of scrap nickel and "demonstrated:" welded the 1/8" sheet from one side, and the 3/16" sheet from both sides, using bare T Nickel Gas Welding Wire. No flux needed.

On the actual jobs, the 3/16" was for the inner shell, the 1/8" for the jacket section. A skirt was welded to the inner shell after testing the tightness in the joined shells.

These kettles are what they call orange peel type, and maybe some slide rule hound can figure out how many feet of weld each kettle mounts up to. What's more, every foot has to be good as these kettles all operate under steam pressure.

The boss tells me that hundreds of such kettles are in use in hotel and restaurant kitchens as well as canning and preserving plants. So while jams may get into the kettles, the kettles don't get into jams.

Hoping you don't too,

Nick Rodder

INCO WELDING SERVICE

INCO WELDING RODS and FLUXES

for PURE NICKEL

Oxy-Acetylene . . . "T" Nickel Gas Welding Wire.
Metallic Arc . . . INCO Nickel Metallic Arc Welding Wire No. 31.
Carbon Arc . . . INCO Nickel Carbon Arc Welding Wire No. 21.

for MONEL METAL

Oxy-Acetylene . . . Monel Gas Welding Wire. For flux see * below.
Metallic Arc . . . INCO Monel Metal Arc Welding Wire No. 30.
Carbon Arc . . . INCO Monel Carbon Arc Welding Wire No. 20.

for INCONEL

Oxy-Acetylene . . . Inconel Gas Welding Wire. For flux see ** below.
Metallic Arc . . . Inconel Metallic Arc Welding Wire No. 32.

for NICKEL-CLAD STEEL
(for welding of Nickel side)

Oxy-Acetylene . . . "T" Nickel Gas Welding Wire.
Metallic Arc . . . INCO Nickel Metallic Arc Welding Wire No. 31 and No. 35†.
Carbon Arc . . . INCO Nickel Carbon Arc Welding Wire No. 21.

FLUXES

*INCO Gas Welding and Brazing Flux for Monel Metal.
** "Cromalloy" Gas Welding Flux is recommended for Inconel.
† For vertical welding.
No flux is used for the gas welding of Pure Nickel or Nickel-Clad Steel.

INCO welding materials as listed can most conveniently be obtained through regular INCO distributors.
Detailed welding instructions furnished on request.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

The Welding Engineer

VOLUME 19 OCTOBER, 1934 NUMBER 10

Welding crew arrives at California port after

Constructing a Welded Pipeline and Marine Terminal

in the Persian Gulf

FIFTY-TWO days out from Bahrein Island, practically half-way around the world from San Francisco, the Standard Oil Co. of California tanker *El Segundo* came into her home port, San Francisco, on August 1st, completing a round-trip voyage begun just eight months before, on which she carried a large store of welding equipment, and a number of welders and other classes of workmen. She was the first Company tanker to visit Bahrein. During her stay there a complete marine terminal was built, and through the finished pipeline she took aboard the first cargo of oil to be transported from this new field in the Persian Gulf.

Crew Uses Tanker for Living Quarters

This expedition dates from December 30, 1933, when the tanker sailed with materials and workers for the construction of the marine terminal. Fifty-three days later she dropped anchor about three miles off Sitrah Island, the closest approach for a deep-draft ship. For the next 105 days she served as living and construction headquarters. Daily her personnel shuttled back and forth between ship and shore, busy with the multiple tasks connected with installing a freight-handling pier, completing a road and trestle between Bahrein and Sitrah Islands, laying approximately ten miles of gathering line from the producing area to the shore (work that had been started by The Bahrein Petroleum Co., Ltd., before the tanker's arrival), erecting three crude-oil-working tanks, the bottoms of which were welded and the sides riveted, constructing a ballast-water tank and pumping plant, and more than three miles of submarine pipeline, as well as a score of less important but very necessary facilities to make this new marine terminal an efficient installation. The job was completed about a month ahead of schedule.

Gathering Line Runs Under and Above Ground

The gathering line, of 6- and 8-inch pipe, was laid across a rough and dry country, though some marshy places were encountered. The welders and helpers had a real task in connection with the gathering-line work, but it went forward rapidly. Numerous bends were welded into the line to take care of expansion and contraction of the exposed pipe. Trenches were dug by local laborers, none of whom had had previous experience with pick and shovel; they also placed the pipe in position and assisted the welders. Where the line ran above ground, masonry anchor-blocks were used.

The oil flows by gravity from the wells, in the central part of the island, to a low point in the gathering system. Here it is pumped over a slight rise that rims the interior valley, again to flow by gravity to the tanks at tide-water.

The terminal is located on Sitrah, a small island separated from Bahrein Island by a shallow channel.

Working Tanks Have Capacity of 250,000 Barrels Each

The three working-tanks have a capacity of 250,000 barrels. The tank shells were transported from California, along with the welding and riveting outfits. A 7500-barrel tank was also erected to take care of the ballast-water from incoming ships, for every precaution is taken by the Company to prevent the discharge of oily water into the gulf.

At the terminal, pumping facilities are provided to deliver oil from the working-tanks through the 16,000-ft. sea-line into the ship's tanks at any desired rate of flow up to 5700 barrels an hour. This high capacity is necessary to reduce loading time, although the terminal facilities were designed to handle a production of only 10,000 barrels a day.

Straight as a string, the submarine pipeline runs out into the gulf to the established tanker anchorage, over three miles from shore. Much of the first third of this line is exposed at low tide. Therefore, about 5700 ft. of pipe is supported by masonry piers, and on this stretch tractors and motor trucks were able to work out on the tide-flats, sometimes in a foot or more of water. The remaining line rests on the gradually shelving bottom, terminating in about 50 ft. of water.

Pipe Sections Are Floated Into Position and Welded

In assembling the pipe, the crew utilized the 800-ft. pier built by Company engineers and local labor for the landing of freight from the native sailing dhows (these swift craft served as lighters in putting freight ashore) that operated between the *El Segundo* and the beach. Industrial railway tracks were laid along the edge of the pier, where the lengths of pipe were lined up on wheeled dollies and welded together in 500-ft. sections, and the two ends closed with blind flanges. Then with tractor-derricks and rope-slings, the sections were slid into the water at high tide, suspended beneath floats, and towed by power-boats to position. There metal horses and chain-falls lifted and held the pipe in place while the flanges were cut off by oxyacetylene torches and the section ends welded together.

Thus a second mile of sea-line was formed. But instead of welding this to the pier-supported portion, a cable was brought in from the anchored tanker, attached to the floating line, and by winch-power the whole mile of pipe was hauled out until its discharge end was in position in deep water. Then the intervening mile was filled in and the three divisions connected up. Early in June the final welds were made, the loading hose and connections were attached, and the oil that had been piped from the wells was pumped from the tanks to the *El Segundo*.

St. Louis Welding Society Elects New Officers

The St. Louis Welding Society has laid out a very comprehensive program for the coming year, it is announced by Lockwood Hill, acting executive secretary for the Society. There will be a number of out-of-town speakers. A representative from the Hartford Steam Boiler Inspection & Insurance Co., will address the Society on the welding of A. S. M. E. Code vessels, illustrated with x-ray photographs and other views. An engineer from Anheuser-Busch, Inc., will discuss maintenance problems in large breweries.

The following new officers of the Society were elected on Sept. 25th by letter ballot: President, F. C. Fantz, Midwest Piping & Supply Co.; vice-president, R. C. Thumser, Monsato Chemical Co.; and treasurer, L. T. Clarke, A. Leschen & Sons Rope Co. The following were elected as directors: Al. V. Fausek, Modern Engineering Co.; Basil N. Osmin, Hill Equipment Engineering Co.; A. H. Wilson, St. Louis Public Service Co.; A. W. Harris, Western Cartridge Co.; S. Petersen, Shell Petroleum Corp.; and A. C. Weber, Laclede Steel Co.

Welding Equipment Displayed at Mining Congress

Welding equipment was displayed and demonstrated at the Exposition of Mining Machinery and Supplies, held in conjunction with the annual meeting of the Western Division of the American Mining Congress, in the Palace Hotel in San Francisco, Sept. 24th to 29th. Representatives of 90% of the mineral production of the United States were in attendance. This Congress came at an opportune time, with California's mining industry in the midst of feverish activity. New mines have come into production and others are rapidly being developed. The reason is the rise in the price of gold from $20.67 to $35 an ounce, all within a short period. Not since the days of the Gold Rush of '49 and the later years of the silver boom in Nevada has interest in mining been so active.

Huge Cable-Laying Plow Built by Welding

Downs Brothers Engineering Co., of 1726 E. Washington Blvd., Los Angeles, Calif., recently designed and built a large all-welded cable-laying plow for use in opening a ditch for laying the ground cable of the high-voltage electric power line now being constructed from the Boulder Dam power plant to Los Angeles. This large plow opens a furrow 36 in. deep and was built for the Los Angeles Department of Power and Light. It is drawn by two or three crawler-type tractors (depending upon the nature of the terrain), ranging from 60 to 80 hp. capacity.

Simple System for Welding Cast-Iron Engine Heads

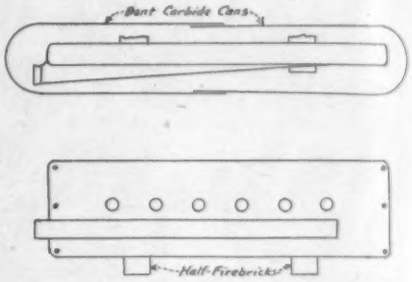
A simple and inexpensive means of welding broken cast-iron engine heads is being used by Art Rack, proprietor of the Toledo Welding Co., Toledo, Ohio. Mr. Rack stands the head on edge on two half-bricks, with the flat sides absolutely perpendicular with the floor. The heavy side of the head is always placed down, as shown in the drawing, regardless of the location of the break. He then constructs the furnace out of two U-shaped sheets, made by cutting the ends out of carbide cans and then slitting the can lengthwise and bending to shape. These sheets are put around the head with the ends overlapping, as shown in the drawing, and with only about 2 in. clearance around the cast-iron head. In the case of a very long casting, the U-shaped sheets are placed at each end and the gap at each side is closed with two straight pieces of tin of the same height as the end sheets. A torch is used to burn two rows of holes, about ⅞ in. in diameter, along and near the bottom of these sheets.

It is very important that the head be checked to make sure it is absolutely vertical, after which the furnace is filled with charcoal to almost the top of the casting. The charcoal is lighted about 2:30 or 3:00 p.m., so the head is ready for welding just before closing time. To light the charcoal, it is usually sufficient to run a welding torch, with a fairly heavy tip, rapidly over the charcoal in a path encircling the casting a couple of times. This starts the heat slowly, and then a flattened carbide can, punctured with quite a number of vent holes, is laid across the top.

When the casting is at the right welding heat, it is lifted out of the furnace with a pair of tongs, laid down flat, and then welded as rapidly as possible. With the ordinary cracked head, the casting will not be out of the fire longer than 3 to 5 minutes. Welding of this kind can be done much more quickly than many think, and the head does not cool off much before it is back in the fire again, in the same position on edge as formerly.

Then the furnace again is filled up with charcoal, the cover put in place, and if the welding was properly done there is nothing more to worry about. The next morning the fire is out, the head is cold, and all that remains is to clean up and test.

This procedure results in a first-class job with no lost time. Moreover, the cost is low, and can be computed as follows: Firing the head is about 5 minutes' work, which at $2 per hour is 16½ cents. Welding time is about 5 minutes, and the rate of gas consumption is about 15 cu. ft. per hour for each kind of gas, or a total consumption during the five minutes of 3 ft. of both oxygen and acetylene, which, at say 7 cents per cu. ft., gives a gas cost of 21 cents. With 16½ cents for the welding time, and assuming a high figure of 50 cents for charcoal costs for a small head, and another 16½ cents for removing the head from the fire in the morning and brushing up, we arrive at a total cost of $1.20½, without profit on labor and gases. The difference between this figure and the price given the customer takes care of the time consumed in testing and leaves a nice profit besides.



Illustrating Set-Up of Engine Head for Welding.

These figures fit the average head with the average break. For a longer break, the gas and welding-time costs are the only ones that will vary. Repair of heavier heads of course will be higher, but the selling price is likewise greater.

Mr. Rack points out that with this method the customer receives a head that is in better condition than the original because it has been thoroughly annealed and is absolutely strain-free.

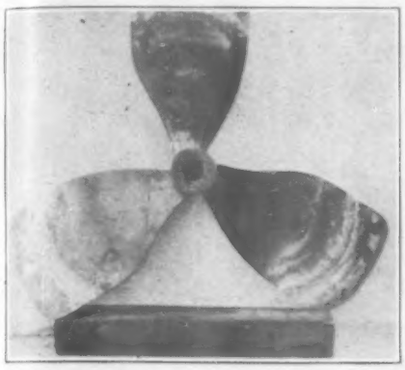
The suggestion is made that a straightedge be used on a head when the customer brings it in, so if it is warped at the beginning the welder will not be blamed for a condition for which he is not responsible.

With these small furnaces, Mr. Rapp can keep the fires back in the shop away from the cars. Frequently he has four or five heads being heated at the same time, each in its individual furnace.

Welding Shop Engages in Marine Repairs

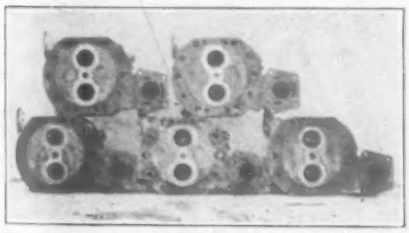
Being located on an arm of Tampa Bay, in Florida, the Pinellas Machine Co., of St. Petersburg, obtains considerable marine work of an interesting nature.

One of the illustrations shows the propeller of a tug boat with the blades enlarged by welding, increasing the diameter of the propeller from 36 to 44 in. The material of the blades is Muntz metal. Additional pieces were added to each blade by bronze welding with the oxyacetylene process.



Pieces Added to Muntz-Metal Propeller Blades by Bronze Welding.

A Winton Diesel coast-guard engine, the cylinder heads of which have been built up by gas welding, is shown in the other illustration.



Cylinder Heads Built Up by Welding.

Builds Up Worn Wheel Hubs by Metal Spraying

The metal-spray process has proved very satisfactory in the building up of worn wheel hubs of trucks and buses where wear has occurred under the outer bearing race. The ordinary wear is between 0.008 and 1/16 in. The procedure used by the Modern Machine Shop, of Danville, Ill., is as follows:

If the metal is badly oil soaked, the hub is chucked in a lathe and a fine cut taken; otherwise, if the metal is clean, a cut is not made. The surface to be built up is then given a stiff treatment of sandblasting. In this case sand is used instead of metal grit. The surface is then built up by applying metal with a spray gun, using 3/64-in. Swedox copper-coated gas welding wire of low-carbon content. The deposit is soft and machinable.

A few customers insist on a harder deposit, in which case a high-carbon wire is used and the surface must be ground to size after the metal is applied.

The surface is built up slightly over size, and after machining or grinding to size, the race is pressed into place.

These hubs are reclaimed at a much lower price than the cost of new hubs. Before the use of the metal-spray process for this purpose, several different methods of repair were tried, and while some of these were successful, many failures also resulted.

Speedy Arc-Welding Repair of Cast-Iron Housing

A rapid job on welding a broken cast iron bearing housing by means of the electric arc, was completed a few months ago by A. H. ("Al") Bond, proprietor of the Bond Welding Shop, in Grand Rapids, Mich.

The housing, which came from a tractor, was 15 in. long and was bored out lengthwise so that, with the babbit lining, it would take a 3-in. shaft. On each end of the casting was a lug, 1x2x4 in. high, which had been broken off, and the job was to weld these back on. Mr. Bond was instructed not to harm the babbit bearing, so the problem was complicated by the fact that the lugs were broken off close to the casting. The following procedure was used:

First, the bearing was well stuffed with very wet asbestos paper and the lugs were lightly tacked in place with "Arcast" rod. The break on one lug was then burned out one-half way through with the arc, and immediately welded, then turned over and burned out the remaining distance on the other side and welded. The same procedure was followed for the second lug, and then the casting was allowed to cool.

Examined when cool, the casting was found to be true, it looked well without any dressing, and the babbit bearing was in as good condition as before welding was started.

One-quarter-inch "Arcast" electrodes were used, with about 150 amperes, and the work ticket showed less than 20 minutes consumed on the entire job. The welds were made so rapidly, said Mr. Bond, that the heat didn't have an opportunity to penetrate far into the casting.

The procedure employed by Mr. Bond on this job was picked up by him while watching Mr. Nyquist, who manufactures the "Arcast" rod, demonstrate its use in the booth of the C. E. Phillips Co. at the welding show conducted last spring in Grand Rapids by Michigan Gases, Inc.

"It certainly pays to attend these welding shows," said Mr. Bond, "because an old-timer can easily become an older-timer if he doesn't keep his eyes and ears open."

Handrails Cleaned and Welded to Check Rusting

Because of serious rusting of the handrails on the bridge at Milwaukee and Desplaines Aves. in Chicago, it was necessary to make repairs. For this purpose, the welding arc was used. These railings, which are a block long, consist of two horizontal pipes at top and bottom, supported at regular intervals by vertical pipes, which are bolted to the bridge floor. Vertical strips forming the lattice work between the pipes end in horizontal channels, the lower channel resting on the bottom pipe, with the upper channel directly under the upper pipe, as one of the illustrations shows.

Cleaning Handrails for Welding.

Welding Toe of Channel to Pipe.

The channel iron had severely corroded, leaving a considerable gap between it and the pipe. This also contributed to the formation of rust. The repair consisted in scraping off and cleaning the pipes and lattice work, and then laying a welding bead along both sides of the upper and lower channels, thus closing the gap between the channel flanges and the pipe and preventing the collecting of dirt and moisture.

Arc Welding Cuts Maintenance Costs in Rock-Products Plants

■ By A. F. DAVIS
Vice-President, The Lincoln Electric Co.

ARC welding makes great savings in the maintenance of the machinery used in rock-products plants, because it mends broken parts, fuses additional metal on worn grinding and crushing surfaces, and actually fabricates many new pieces of equipment.

Comparison of the cost of welded repairs with the cost of replacement will show in many instances enough savings to pay the cost of the welding machine in less than a month's time.

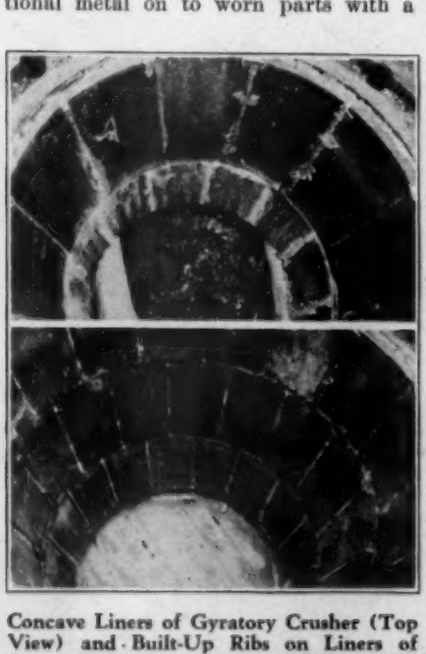
Some of the many uses to which arc welding is being put in crushed-stone plants today are shown in this article. A few of the more unusual jobs are explained in detail, these including repairs on hard-steel as well as mild-steel parts.

Where mild-steel parts are being repaired, a coated electrode is recommended in preference to bare or washed electrodes because of the greater strength of shielded-arc welds, and the fact that the welding speed can be increased 100% to 300%. Better welds, lower repair costs, and less time lost while repairs are being made, all lead to great savings.

Building Up Manganese-Steel Wearing Surfaces

Where new manganese-steel wearing surfaces are built up by welding additional metal on to worn parts with a high-manganese-steel electrode, the new surface is as resistant to abrasion and wear as the original part, or even more so. The life of the part rebuilt by arc welding is often many times that of a new part. Welds produced by a high-manganese electrode of the proper type have a flat bead with no surface checks. The weld metal has a high density and is extremely tough and hard. Resistance to wear is equal to that of heat-treated cast manganese steel.

Either mild or high-carbon steel may be hard surfaced by using special electrodes. With a little practice any welder can build up worn parts to resist severe shock and abrasion. Recent tests show that the hardness of such deposits will be from 40 to 45 Rockwell C when deposited on mild steel, and from 50 to 55 Rockwell C on high-carbon steel.



Concave Liners of Gyratory Crusher (Top View) and Built-Up Ribs on Liners of Primary Crusher (Bottom View), Both Shown After One Year's Run.

(The manganese concaves in the top view were built up by building ribs on flat surfaces with 5/32-in. and 1/4-in. manganese-steel electrodes. In both views, the liners show but little wear.)

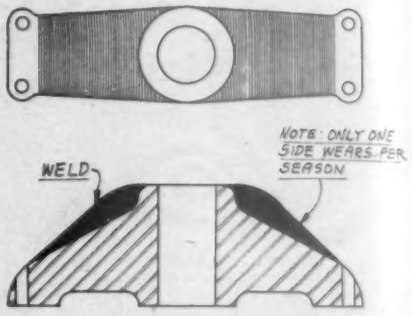
Resurfacing Crusher Parts at 25% of Cost of New Ones

As a typical example of the savings made by arc welding, take the principal parts of a cone crusher which have been worn beyond use. Several hundred dollars would be required to replace the bowl liner and mantle, which figure does not include the extra expense of lost operating time. These parts are reclaimed by arc welding at only 25% of the cost of new parts, by building them up quickly with the electric arc.

Other examples of the great savings made by arc welding in one plant are: rebuilding the mantle and concaves of a gyratory crusher for one-fourth the cost of new parts; rebuilding a dipper front for approximately one quarter of the original cost; reclaiming shovel traction links for $10 to $30—parts that cost new $50 to $125; rebuilding dipper teeth for less than a third the cost of new ones; restoring a gear, which would cost $85 and take 7 hours to replace, for $10 in 2 hours.

Repairing Broken Joints and Leaks in Water Lines

In water lines, arc welding is used to repair broken joints and leaks, also to make new connections to existing lines. Where large leaks are present, a section is cut out of the line and a new sleeve welded on. Pinhole leaks are repaired by welding a patch to the line. The thickness of the pipe to be repaired determines the size of electrode to use. For smaller sizes, 5/32-in. coated electrodes are used; for larger sizes, 3/16-in.



Method of Building Up a Gyratory-Crusher Spider and of Hard-Surfacing With a High-Manganese-Steel Electrode.

Locomotives Are Quickly Reconditioned

Immediate repairs to locomotives are frequently necessary. Shielded-arc welding easily and effectively repairs frame breaks. A common locomotive repair job is the welding of flues. Welds are made from the top of the tube down each side, using a 5/32-in. or 3/16-in. coated electrode. To avoid localizing heat in one section of the flue sheet, adjacent flues should not be welded consecutively. Side sheets and flue sheets which have become rusted and weakened can be built up by depositing layers of weld metal on the thin plate until proper thickness is secured. In case the sheet is thin over a large area, it is often advisable to weld on a patch instead of building up the plate. Welding is also extensively used for building up worn locomotive tires and car wheels.

Welding of Screens and Screen Frames

Vibrating-screen frames which break as a result of their severe duty, can be made even more substantial than when new by welding with mild-steel coated electrodes.

Manganese screens usually become thin in spots owing to the fact that certain parts are subjected to harder wear than others. This means that the entire screen would have to be replaced with a new

one, if it were not possible to reclaim it by welding. Original thickness and strength of screens can be restored readily with a high-manganese-steel electrode.

Procedure for Building Up Worn Shafts

Shafts wear rapidly at the stuffing boxes and bearings due to the large quantities of fine dust present in a rock-products plant. These worn shafts can be built up with ordinary mild-steel electrodes and then turned down to proper size. Without welding, these shafts would have to be discarded for new ones. In order to keep the heat equalized on each side, it is best to run beads parallel to the axis of the shaft, rotating the shaft 180° after each bead.

Broken truck frames can be easily welded with a heavily coated steel electrode.

Damaged, weakened or loosened crane booms can be renewed by welding on patches or replacing damaged members.

Track sprockets of crawler-type tractors, and cast steel racks and pinions, can be reclaimed by building up worn teeth by depositing layers of heavily coated mild-steel electrodes until the tooth is shaped to its normal size and then hard-surfacing with high-carbon steel rod.

Building and Repairing Chutes and Hoppers

New chutes and hoppers can be easily constructed by simply cutting the usual ¼-in. plates to shape and welding them together. Building these pieces of equipment by arc welding saves 35% to 65% as compared with having them made outside by riveting. The latter method also makes it necessary to lay out such jobs. Chute parts which are subject to abrasive action can also be hard-surfaced with a high-carbon-steel or high-manganese-steel electrode. This hard-surfacing greatly increases their wearing qualities.

Shovel points can be built to size and hard-surfaced with the manganese-steel electrode.

Repairing Cast-Iron Head of Gypsum Kettle

An effective job of repairing that could be done profitably in gypsum plants was performed recently by arc welding. This was the repair of a cast-iron head of a gypsum kettle, in the Cleveland plant of the United States Gypsum Co.

Three large cracks, about 5 ft. long, rendered this kettle absolutely useless. The head is about 15 ft. in diameter and approximately 2½ in. thick, and is concave on the upper surface. In use, the gypsum is above the head and the heat below.

Arc welding saved time and money over previous methods of repair, which consisted of bolting or riveting plates over the cracks. The cracks were chiseled out to the bottom with an air chisel and then welded with a coated electrode having a steel base and providing a solid weld on cast iron. Approximately 100 lb. of weld metal sufficed for the job.

Building Up Worn Parts of Gyratory Crushers

The cast-iron spiders in gyratory crushers wear rapidly because they receive the impact of the rock when it is dumped into the crusher. Spiders which have been worn until practically worthless have been built up successfully by welding on a pad of 18-8 stainless steel and then applying a layer of high-manganese-steel electrode for a protective coating. Adding a layer of manganese steel, when necessary, keeps the spiders in good shape. This method is illustrated in the accompanying sketch.

Unretouched Photograph of Manganese-Steel Mantle Built Up by Arc Welding (Top View) and View of Welder Building Up the Head of a Primary Crusher (Bottom View).

(High-manganese electrodes were used for both jobs. Top view shows that mantle has suffered but little wear after 18 months' use.)

The crushing action of gyratory crushers has been made much more effective by building up ribs on the liners of concaves.

Manganese-steel beads or mantles of gyratory crushers when built up with high-manganese electrodes give long service between repairs. The same is true of the built-up ribs of liners of primary crushers. High-manganese electrodes are also used for building up the heads of primary crushers.

In case the head of the gyratory crusher is chilled cast iron instead of manganese steel, the following welding technique can be followed successfully for building up ribs:

Procedure for Building Up Chilled Cast-Iron Parts

Use high-manganese-steel rods, and lay short beads, not exceeding 2 in. in length, on one rib. Then skip to another rib, and lay another 2-in. bead. Follow this procedure through the entire operation in order not to get the bead too warm. Lay each bead transverse to the axis of the shaft and peen it carefully as it cools.

I. A. A. Convention to Be in Pittsburgh

The tentative program of the annual convention of the International Acetylene Association was published on page 33 of the October issue of *The Welding Engineer*. Later details regarding changes in the program had not yet been received at the time the forms were closed for this issue. The convention is scheduled to be held at the William Penn Hotel, Pittsburgh, Nov. 14th, 15th and 16th.

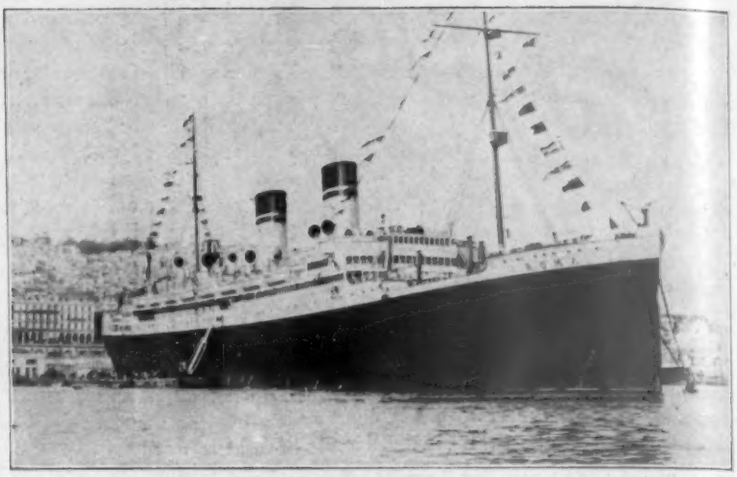
NRA Puts Welding Shops Under Machine Shop Code

In accordance with the expressed desire of the Federal Administration and the NRA to consolidate codes wherever possible and to add no more basic codes to those already in existence, the NRA has definitely designated the code of the Special Tool, Die and Machine Shop Industries as the code under which shall operate all shops engaged in welding repair or contracting as a business.

This code, which was approved by President Roosevelt on Nov. 17, 1933, has already been subscribed to by 3206 small shops throughout the country. These shops can generally be described as machine shops, though many of them do some welding.

Welding shops and contractors are invited to file a code for their industry, which will be supplementary to this basic code, after which local groups can file Codes of Fair Competition for their respective territories.

Roy T. Wise, executive secretary for the Code Authority of the Special Tool, Die and Machine Shop Industries, with offices in the Guarantee Title Building, 9th and Superior, Cleveland, Ohio, called a meeting in Cleveland for Oct. 12th and 13th to give local and regional associations of welding shops an opportunity to discuss these new developments as regards a welding code and to take whatever action they deemed desirable. Owing to the inability of various associations to be represented, the meeting was cancelled a few days before the date set, but another effort will be made soon to get the welding groups together, says Mr. Wise.



The Passenger Liner Roma Was One of the First Vessels to Have Welded Ventilator Hoods, Piping, and Other Parts

The Status of Welding in Marine Construction

■ By PAUL ORR
Westinghouse Electric & Manufacturing Co.

WHEN welding is introduced into an industry, the technique must always be modified to meet certain special requirements that are peculiar to that industry. The requirements of ship-building are no exception. In general, the tendency is toward more rigorous specifications not only for work in the hull itself but for minor parts. The failure of a minor part while the vessel is at sea, means putting up with some makeshift until she reaches port. While it is true that the marine engineer is possibly the most resourceful mechanic that has ever been developed, every effort possible is made to forestall the necessity for exercising his skill. Thus the welding job which would be perfectly suitable in an industrial plant might not pass on shipboard.

Lighter Weight Adds to Cargo Capacity

While naval designers are attracted to welded construction on account of lightness, they must see to it that the soundness of the work is unquestionable. Perhaps in no other field outside of air navigation is lightness such an important consideration. Every pound that can be eliminated with safety from the construction is a pound added to cargo capacity and therefore constitutes added dividend power. Only the conservatism of the seafaring industry, which insists on every new idea proving itself, prevents the more rapid adoption of welding in ship construction.

Perhaps the most outstanding problem to be met with on shipboard is that of eternal vibration when under way. Dynamic machines which purr quietly on a concrete foundation, have a tendency to make themselves heard when afloat. Ships have a natural period of vibration, and any part which is at all highly stressed will be subjected to stresses far exceeding those due to its normal function. Superimposed on this monotone of vibration from the ship's machinery are the extra stresses due to wave impact, causing buckling and twisting of the hull and parts attached thereto, and also to the constantly shifting support which the waves afford to a waterborne structure.

It should also be borne in mind that if a riveted joint shows signs of distress, it is often possible while at sea to drill out the defective rivets one by one, ream the holes and substitute bodybound bolts. But if a welded joint starts to fail, even though quite accessible, its repair is not usually so simple a matter. So shipbuilding specifications have been crystallized by years of experience to meet the drastic requirements; and welding, as it is introduced into this field, must be modified accordingly.

Ventilator Hood Welded Up From Plate Segments.

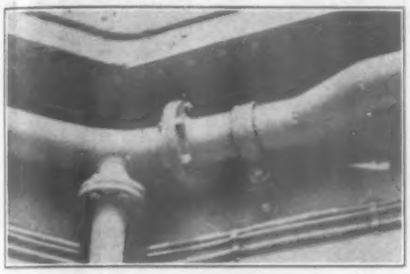
Welded Construction Goes Back Six or Eight Years

Passing now to the historical review of the subject: Such old ships as the *Aquitania* have no welding in the original construction. Only in repairs is welding in evidence.

However, a vessel built six or eight years ago shows welding having been used. For instance, the steamer *Roma*, launched in 1926 at the Ansaldo Works near Genoa, Italy, is a fairly large liner

Welding Was Used Extensively in the Construction of This Oil Tanker by the Compeador Shipbuilding Company.

built for passenger service on a scheduled run. Everything about her equipment must therefore be A-1. A survey of such a vessel develops the fact that many minor parts and some major equipment is welded. The drain piping for conducting rain and wash water from the upper decks is freely welded in order to conduct it around obstructions. The large ventilator hoods which cluster so conspicuously around the stacks are, on close inspection, found to be welded of many segments. However, free use of



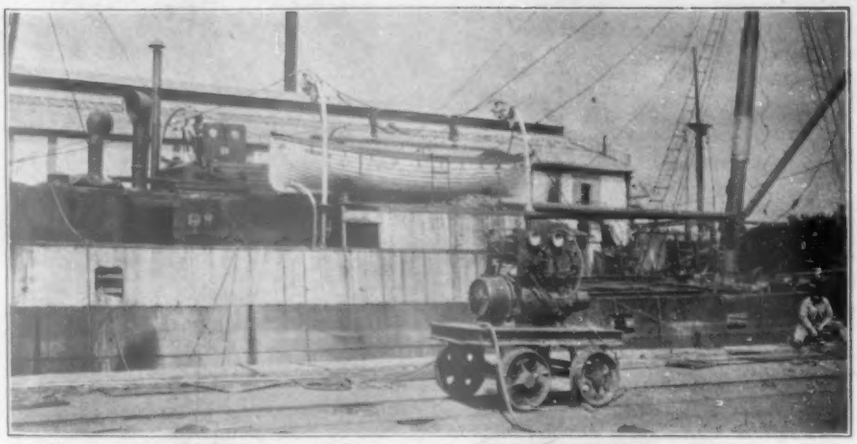
Welded Offset and Branch in Piping System.

filler and paint makes the welded joints hard to detect unless one is looking for them.

Welding Simplifies Problems of Pipe Installation

In the engine and boiler rooms water pipes, low pressure up to 8 in. and high pressure up to 6 in., are welded, as are also the oil lines. Welding greatly facilitates the pipe installations on shipboard when the conditions are so crowded that very intricate shapes are required. The most complicated offsets and bends are freely obtainable by this method. The practice is generally to use flange joints at necessary intervals to facilitate assembly.

At this period the only use of welding was the building up of corroded spots in the furnaces. In fact, the use of welding for repairs is the way in which this method is getting its "foot in the door."



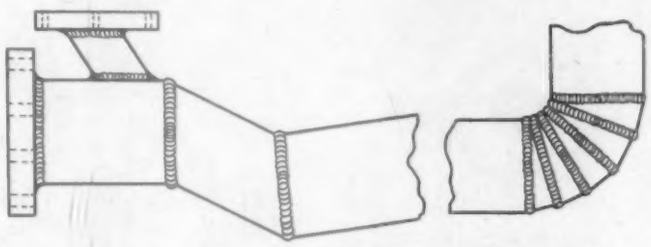
Welder Working on Vessel in Repair Dock.
(The portable direct-current welding unit runs on rails parallel to the dock, enabling any part of the steamer to be reached.)

Building and Repairing Oil Tanks

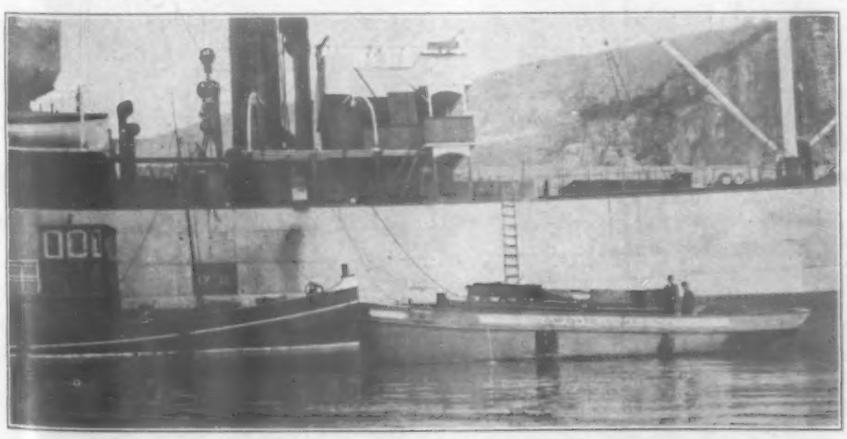
While examining a vessel of this period, one notices that the oil tanks are built of rectangular shapes; the plates forming the walls having been riveted into angle iron pieces at the corners. Eventually these riveted joints began to leak. They were readily repaired by the electric-arc process. The weld was carried from one plate edge to the other, thus tying the two plates and angles into one solid piece. The latest addition to this line is the *Rex*, in the construction of which welded fabrication has been used still more extensively.

Many barges have been constructed entirely by the welding process. A steamer was constructed by this process last year at Charleston, S. C. Also, an ocean-going welded vessel has been constructed in Germany.

In general, it is believed that eventually this type of construction will supersede riveting for seagoing vessels, provided welding progresses in the future as rapidly as it has in the past. While it is true that the strains encountered by the hull in a seaway are very severe, yet riveted joints stand it, and riveted joints (even triple riveted joints used in boiler practice) are not 100% efficient. Welded joints can be made 100% efficient and at the same time eliminate the necessity of caulking. The all-welded ship is coming and probably faster than one realizes.



Characteristic Examples of Marine Pipe Welding.



Harbor Work Boat Equipped With Arc-Welding Unit Is Capable of Giving Speedy and Efficient Repair Service.

October Meeting of Los Angeles Section

The October 18th meeting of the Los Angeles Section of the American Welding Society is scheduled to be held at Cole's Cafeteria, at 6510 Pacific Boulevard, in Huntington Park. Following the usual 6:30 plate dinner, two speakers will make interesting talks. George T. Piersol, of the American Brass Co., will speak on "Developments in Arc Welding of Copper," and R. McBeanfield, consulting engineer, will discuss the welding of structures.

Evolution of Welding-Generator Design—III

Last of a Series of Three Articles

■ By K. L. HANSEN
Consulting Engineer, Harnischfeger Corp.

IT HAS been pointed out in these articles that the stabilizer absorbs and stores energy when there is an excess from the welding generator and gives up energy when there is a deficiency in energy output from the machine. It has also been explained that excess and deficiency of energy are occasioned by changes in the arc resistance taking place too rapidly for the generator to follow them.

To be more explicit, the action of the stabilizer in absorbing and giving up energy takes place as follows:

Action of Stabilizer in Limiting Momentary Changes in Current

When there is a sudden decrease in arc resistance, as, for example, when the arc is short-circuited by a drop of molten metal, the terminal voltage should instantly drop to almost zero. However, as the generator voltage cannot immediately follow the resistance variation, there is an interval in which the voltage is too high for the arc resistance, and this causes the current to increase momentarily. This increase in current, however, causes a voltage to be induced in the stabilizer by self-induction which is in opposite direction to that of the current itself, and thus tends to limit the momentary current increase.

On the other hand, when there is a sudden increase in arc resistance, the action is precisely the reverse, and the rapid decrease in current causes a voltage to be induced in the stabilizer which is in the same direction as the current and thus tends to limit the momentary current reduction.

Hence, it will be seen that the stabilizer is effective in minimizing the current

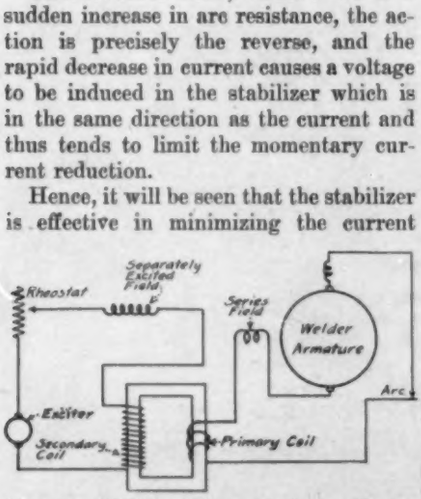


Fig. 13. Wiring Scheme Using a Transformer as a Stabilizer to Improve Arc Characteristics.

fluctuations incidental to resistance variations of the arc.

It was soon realized, however, that with a stabilizer in the form of a plain reactor, the limit of stabilization was soon reached. The benefit which could be derived from any further increase in the reactance would be so slight as to make it economically impracticable. If further improvement was desired, special forms of stabilizers had to be developed. Two designs of such stabilizers will be briefly described.

The cause of the generator's inability instantly to adjust its voltage to resistance variations of the arc is the electromagnetic energy stored in the field of the generator. Whenever there is a change in the amount of flux in the field, there is a voltage generated in the shunt-field windings, which causes variations in the field current always in such manner as to oppose the change of flux.

It is this opposition of the field itself to changes in the magnetic flux interlinked with its windings, which is responsible for the terminal voltage lagging behind sudden changes in arc resistance. This action of the field is known as the mutual reactance or transformer action between the shunt and series field, if a series field is used to produce the drooping volt-ampere characteristic. If armature reaction instead of a series field is depended upon to furnish a drooping characteristic, the action is exactly the same, except the mutual reactance is then between the shunt field and the armature.

Means for Neutralizing Induced Voltage in Field Windings

By impressing a voltage on the field winding of correct magnitude at the proper instant, the voltage induced in the field by transformer action which is responsible for the sluggishness of the machine can be obviated to a large extent. This scheme results in making the machine much more responsive to the changes in resistance of the external circuit. A method of doing this has been described by Mr. Blankenbuehler in a paper, "An Improved Arc-Welding Generator" (Transactions A. I. E. E., Volume 50).

Fig. 13 shows a diagram of the scheme described by Mr. Blankenbuehler. It will be observed that instead of a plain reactor, the stabilizer consists of a transformer, the primary coil of which is connected in series with the arc and consists of a relatively few turns of heavy conductor. The secondary coil, consisting of a relatively high number of turns of fine wire, is connected in series with the separately excited field and the exciter.

When the current in the arc circuit, and therefore in the primary coil, undergoes rapid variations, voltages are induced in the secondary which are of such magnitudes and directions as to tend to neutralize the transformer action between the separately excited field and the differential series field, thereby resulting in a marked improvement in arc characteristics.

However, from the design standpoint the scheme has some disadvantages. It will be observed that current is always flowing in the secondary coil of the transformer, which results in a certain amount of energy loss.

Furthermore, the primary and secondary coils are cumulative with respect to each other, which means that the flux pulsations produced by the primary are superimposed on the steady flux produced by the exciting current. To prevent saturation, the cross-section of the

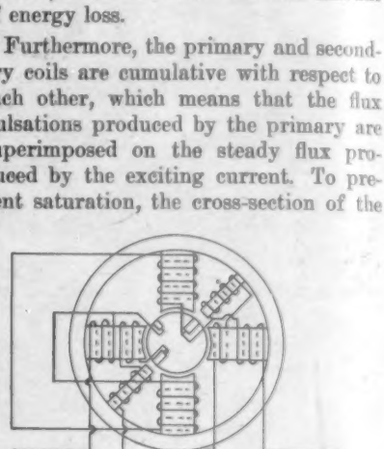


Fig. 14. Scheme Employing Transformer-Reactor Type of Stabilizer.

magnetic circuit of the transformer must have a relatively large area, which makes the transformer rather bulky.

Moreover, high voltages are generated in the secondary coil of the transformer and the separately excited field of the generator. To prevent break-downs, special insulation must be applied to the circuit consisting of the exciter, the separately excited field, and the secondary coil of the transformer.

Transformer-Reactor Scheme for Obtaining Stabilization

Fig. 14 illustrates an intermediate form of the stabilizer between the reactor and transformer and is known as the transformer-reactor, described by Bergman in a paper, "A New System for D. C. Arc Welding" (Transactions A. I. E. E., Volume 50). The combined effect of the transformer and reactor is obtained by providing a leakage path between the primary and secondary coils as shown in the illustration. This has the advantage of lower voltages being generated in the secondary coil, but at the same time it does not so completely neutralize the transformer action between

the field coils as does the straight transformer.

The modifications thus far discussed have pertained to external stabilization. Corresponding modifications have also been made where internal stabilization is employed.

Obtaining Faster Response With Internal Stabilization

In the case of internal stabilization, because of the close proximity of the stabilizing winding to the shunt windings, it becomes a simple matter to couple them together magnetically in such a manner that current impulses in the stabilizing winding are transmitted to the shunt windings and thereby assist in speeding up flux changes in the field. This is accomplished by means of a turn of heavy copper, short-circuited upon itself and so placed that it interlinks the flux of the stabilizing winding and part of the flux of the main field.

Fig. 15 shows an assembled pole piece with the short-circuited winding in place. Three sides of the short-circuited coil consist of heavy copper wire, and the fourth side is made up of two flat straps brazed to the wire. The flat side of the coil lies in the slot with the stabilizing winding on the top. There is no insulation on the short-circuited coil.

At first sight it might seem that the flux from the main pole would interlink with the stabilizing winding and make the short-circuited winding unnecessary, but a little reflection will show that such is not the case. Consider, for example, flux lines *a* emanating from the main-pole body in Fig. 16. They enter the stabilizing winding but return to the frame through the adjacent pole pieces without forming a closed loop around the stabilizing-winding conductor. They interlink with the shunt windings but not with the stabilizing winding. On the other hand, flux line *b*, it is readily seen, interlinks with the stabilizing but not

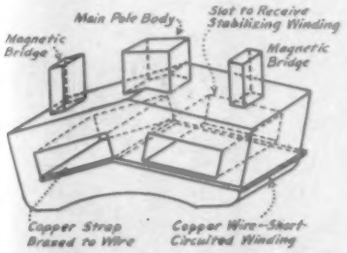


Fig. 15. Assembled Pole Piece With Short-Circuited Winding in Place.

with the shunt windings. Hence, except for an incidental saturation effect which can be disregarded, the shunt windings and the stabilizing winding are non-inductive with respect to each other.

As long as the shunt and stabilizing windings are non-inductive with respect to each other, a change of current in the stabilizing winding will induce no voltage or current in the shunt windings. However, when the short-circuited winding is added, it creates some degree of mutual induction between the shunt and stabilizing windings.

It will be observed from Fig. 16 that the flux lines *a* and *b* both interlink with the short-circuited winding; and since *a* interlinks with the shunt windings and *b* with the stabilizing winding, the short-circuited winding is inductively related to both, and hence it serves to transmit current impulses from one to the other. It is so connected that when the current in the stabilizing winding is increasing, the current induced in the short-circuited winding assists in reducing the flux of the main poles, and vice versa. In this manner it makes the terminal voltage more responsive to external resistance changes.

As compared with the methods already discussed of obtaining faster response, the method just described does not involve an enlarged magnetic circuit or high-voltage induction in a secondary coil with a high number of turns. Furthermore, its simplicity is self-evident.

Voltage Recovery Speeded Up With Magnetic Bridge

However, it does not fulfill the aim of fast voltage recovery so completely as might be desired, because the short-circuited winding interlinks with only part of the shunt-field flux. If the speedy voltage recovery demanded of a modern arc welder were accomplished by this means alone, we would again be confronted with undesirable high voltages being induced in the field windings because of the extremely rapid change of flux. But the introduction of an extremely simple device, known as the magnetic bridge, in combination with the short-circuited winding, accomplished the object of very speedy arc recovery, and at the same time entirely obviates the danger of high voltages being induced in any part of the windings.

As shown in Fig. 16, the magnetic bridge is inserted between the shunt winding excited by the auxiliary brushes and the shunt winding excited by the main brushes and extends from the pole flange to the frame.

The two shunt coils are excited in the same direction; and unless the main-pole body is saturated, little flux passes through the magnetic bridge on open-circuit, and what flux there is passes through in the direction indicated by arrow *d*.

On short-circuit, the m.m.f. of the main-field winding disappears, and an opposing m.m.f. of armature demagnetization appears. Now a considerable amount of flux passes across the bridge in the direction of arrow *c*. Therefore, on short-circuit, that flux in the main-pole body which interlinks with the auxiliary-field winding, is not reduced, but most of it is diverted through the bridge. The result is that the energy stored in the auxiliary field changes but very little as the terminal voltage varies up and down. The advantage of eliminating the necessity of changing the energy stored in this field when the external resistance varies is obvious.

A paper entitled "Recent Developments in Design of Arc-Welding Generators" (Transactions A. I. E. E., Volume 51) further describes the functions of the short circuited winding and the magnetic

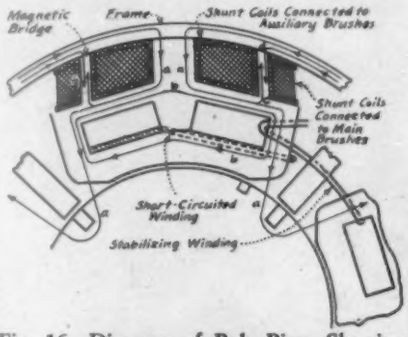


Fig. 16. Diagram of Pole Piece Showing Magnetic Circuits.

(The stabilizing winding is shown diagrammatically. Actually, it substantially fills the slots in the main poles.)

bridge, and points out their simplicity and effectiveness in producing stabilization and in keeping the voltages induced in the field windings down to the minimum.

Detroit Group Hears Talks on "Shot Welding"

"Shot Welding of Stainless Steel as Applied to the Burlington Zephyr" was the subject of a joint meeting of the Detroit Section of the American Welding Society and The American Society of Mechanical Engineers held in the Fort Shelby Hotel, on Oct. 16th. The subject was presented by Edward G. Budd, president of the Edward G. Budd Manufacturing Co., Philadelphia, and by Joseph W. Winlock, metallurgist, of the same company. Motion pictures and lantern slides were used.

Large Attendance at A. W. S. Meeting and Metal Show

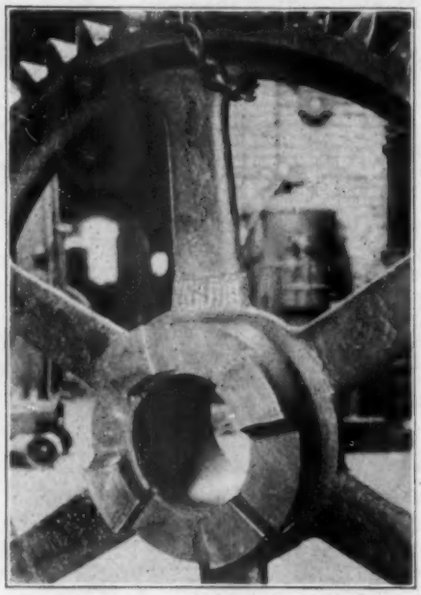
The best attended sessions that the American Welding Society has had for several years, marked the fall meeting of the Society, held in New York City, Oct. 1st to 5th. A high degree of interest was shown in many of the papers presented.

While the attendance at the National Metal Exposition was not as great in numbers as some expected, the quality was unusually high, as a result of the action of the exposition management to eliminate curiosity seekers and youngsters as far as possible.

Repair of Large Cast Steel Gear

A 6-ft.-diameter cast steel gear weighing about 1800 lb., with a fracture in one of the spokes was recently repaired by the Anchor Welding Service, Inc., of Chicago, using the arc-welding process. The gear, after welding, is shown on the front cover of this issue, and a close-up of the weld is shown in the accompanying illustration.

The fracture was beveled with a cutting torch, after which welding was started. No preheating was used. Each



Close-Up View of Welded Spoke.

layer of weld was well peened, says George Hettrick, proprietor of the shop, in order to relieve cooling strains and to improve the structure of the weld metal.

Welded Bolt Serves as Axle Puller

An ingenious scheme for pulling an axle was recently devised by M. C. Gallaher, of the Gallaher Welding Co., Corvallis, Ore., in which welding played an important part. A local garage foreman asked for some kind of axle puller that would grab hold of an axle which was broken off about 6 in. inside the axle housing and was foul in the differential.

The foreman took his problem to Pratt's Machine Shop, in Corvallis, and after a conference between the foreman and Howard Pratt and Mr. Gallaher, a solution was arrived at by taking a portable arc welder over to the garage, welding a bolt to the end of the broken axle with a G-E Type W-20 electrode, and then pulling the axle by using a nut against a washer made for the purpose.

"This may assist another welder to solve a like problem," writes Mr. Gallaher.

Get "*H. O. T.*" on Welding

■ By H. O. T. RIDLON

[This section is dedicated to Better Welding and Better Welding Shops. Suggestions and criticisms are invited.]

Anyway, Cellini Was a Regular Guy

"Deacon" Tom Norden, of Detroit, takes issue with a statement of mine. He writes:

"Dear Hot:
"Leonardo da Vinci was a greater craftsman than Cellini. Very truly yours,
Tom Norden"

So with due humiliation I can but reply: "Vas you dere, Charlie?"

No doubt there were, and will be, perhaps, greater craftsmen than Cellini. Many of you may remember your history better than I do. So it would not be the likes of me to dispute you. We can gauge most things only by comparison. And Cellini was undisputedly a great craftsman and, from what history teaches us, a regular guy. Methinks that if all the welders I know were by comparison as great craftsmen as Cellini was, there would be more welding done, for our customers would have greater confidence in our work. So I feel we should all try to improve ourselves to that point, by trying harder and studying our profession more.

• • •

It Was a Swell Show—And Then Some

The National Metal Exposition in New York City was a grand show, much worth while to see and study. And a fine lot of papers were given at the American Welding Society meetings. But did someone pull a bone-head play, and if their face wasn't red it should have been, because after two days of not being able to demonstrate, the oxyacetylene manufacturers finally had extended to them the great privilege of operating one torch in the building at a time, which gave each manufacturer of oxyacetylene welding and cutting equipment a ten-minute demonstration each hour. Not many of them wanted to wait for the time of the demonstration to start. Anyway, many of them had special things they wanted demonstrated. It was the arc-welding manufacturers that had the break at that show, for they went full blast all day and every day.

• • •

I Hope Santa Claus Reads This

There were a number of optical companies showing very interesting checking and measuring instruments. Great stuff these, and they should help all of us. One thing in particular that struck my fancy was a small portable battery-illuminated shop microscope. Very handy in dark and inaccessible places. And they're not expensive, for they list at $37.50 each, and wherever they fit into the picture they should pay for themselves in short order. I'm going to save my pennies because I'd like to have one myself.

• • •

The thought for the month: It is not the sales losses but the lost sales that count.

Horton and Gibson to Address Chicago Group

Talks on the application of welding to heavy machinery and to plate structures will feature the meeting of the Chicago Section of the American Welding Society, to be held in the Hotel Morrison, on Oct. 26th.

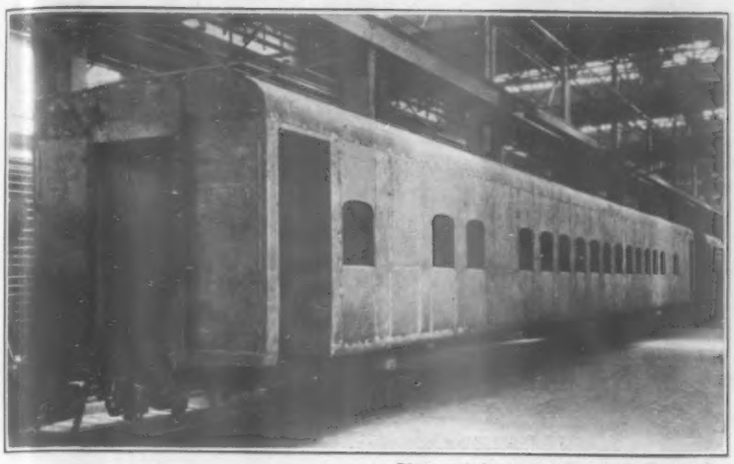
George Horton, president of the Chicago Bridge & Iron Works, will give an illustrated talk on "Field-Welded Tanks." This will be followed by a talk by A. E. Gibson, vice-president of The Wellman Engineering Co., Cleveland, Ohio, on the welding of car dumpers, bridges, steel-mill machinery, gas producers, and other heavy equipment. Mr. Gibson is also chairman of the Cleveland Section of the American Welding Society.

The program will start at 7:30 p. m. and will be held in the English Room on the mezzanine floor. Preceding the meeting, there will be a dinner at 6:15 in the Boston Oyster House, located one floor below the hotel lobby.

Receives Contracts for Pipeline Welding

H. C. Price, Inc., of Bartlesville, Okla., announce that they have completed the electric welding of 20 miles of 8-in. oil line for the Pure Oil Pipe Line Co. in Louisiana. The general contractors were the Apex Construction Co. The welding was completed in 21 working days.

Two contracts for the electric welding of pipelines in California were recently awarded this company. One is for the welding of 8900 ft. of 54-in. water line for the city of San Francisco; general contractors are Barrett & Hilt, of San Francisco. The other contract is for the welding of 35 miles of 12-in. oil line for the Standard Oil Co. of California; the general contractors on this project are Lindgren & Swinerton, Inc.



Photograph Courtesy of The Lincoln Electric Co.

One of Fifty-Two All-Steel Passenger Coaches.

All-Welded Construction for new Milwaukee Coaches

SAVINGS of 35% in weight are made possible by the use of arc welding in the construction of 52 new streamlined air-conditioned steel passenger coaches which the Chicago, Milwaukee, St. Paul & Pacific Railroad is building in its Milwaukee shops for both day and night service between Chicago and the Pacific Coast. The new construction of these coaches, made possible through the use of arc welding, will bring about new economies in train operating costs and will facilitate higher speeds. In addition to the savings in operating costs, the company saves the price of thousands of pounds of steel in construction of each coach.

These new coaches are of conventional size, being 80 ft. 8 in. long over the pulling faces of the couplers, 10 ft. wide and 13 ft. high above the rails. Yet the weight of each coach is only 96,000 lb. as compared with 146,000 lb. for the conventional Milwaukee coaches of the same size.

The new coaches are tubular in shape and streamlined to the extent that they have a turtleback roof, side sheets rounded inwardly, and no projections such as window sills, belt rails, etc. The entire body is electrically welded without the use of rivets. Floor pans are of ⅛-in. sheets joined to each other and to the car frame by continuous, and in some places, staggered welds, the latter overlapping. Body and vestibule end-frame construction is built up of steel shapes, pressings and sheets, also joined by welding. The turtleback roof is formed of 3/16-in. side plates and 1/16-in. roof sheets, which are welded, as well as the ridge pole of steel strips between the center-pan flanges.

Underframe Construction of Steel Coaches

A built-up design consisting of structural shapes, plates and sheets joined by welding, is the basis of the underframe construction, which includes the center sill, bolsters, buffer beams and body end sills.

In welding the pan-like sections of the floor structure of the cars, they are assembled together with flanges upward. The flanges are then spot welded, after which the entire assembly is turned over and welded continuously with the shielded carbon-arc process.

The flanges of the floor pans extend from one side sill to the other. The welds joining this under-frame floor structure to the center sills are intermittent.

The side sills of the cars are 4-in. 8.2-lb. Z-sections, extending from one corner post to the other.

The sides of the coaches consist of three different sizes of pans, all joined by welding. All side pans are fabricated from ⅛-in. sheets. Structural strength is gained by forming flanges on sheets to give angle and channel effect.

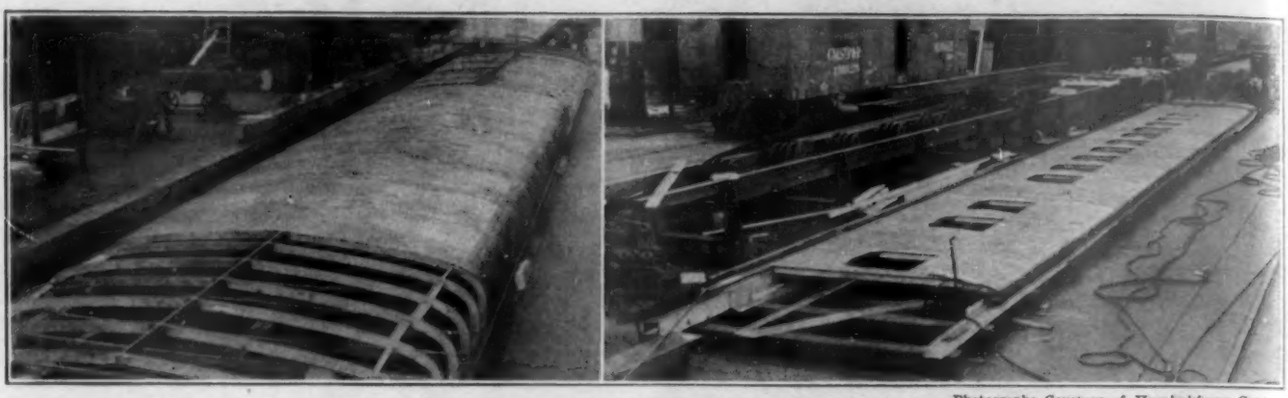
The first-size pan used in the side construction extends between the windows from the side sill to the side plate. The second-size pan extends from each window down to the side sill. The top flange of these pans forms the window sill. The third-size pan extends from the top of the window to the side plate. These pans have angle-shaped flanges on all four sides.

Pressings used in the coach side construction are made with open corners

Photograph Courtesy of The Lincoln Electric Co.

Roof Sections Are Joined Together by Means of an Automatic Carbon-Arc Welder.

Side Pans Are Clamped in Position and Automatically Welded, Then Corners Filled in by Hand Welding.



Photographs Courtesy of Harnischfeger Corp.

Car Roof and One of the Sides Under Construction.

(later filled in by welding) and with holes punched in the flanges for bolting them together and lining up the superstructure before welding.

The pans forming a side of a coach are assembled in a jig, bolted down, welded automatically, one pan being welded to the other on the smooth outside face. These welds are continuous for the length of the pan.

After the pan corners are filled in with a deposit of weld metal, and after the temporary bolts are removed, the side structure is turned over and the flanges are spot welded to one another.

The window frames are fabricated from 12-gauge steel, pressed into U-shaped contours. Flanges project inwardly to coincide with the window construction.

The turtle-back roof consists of 1/16-in. steel sheets pressed into pans flanged on all four sides and also 3/16-in. pressed side plates. Steel strips, 1/8x3 in., welded between the center-pan flanges, form the ridge pole.

In welding the roof pans, a strip projects above the surface of the pans and the carbon arc used in the automatic welding melts the strip down, thus providing filler metal between the flanges.

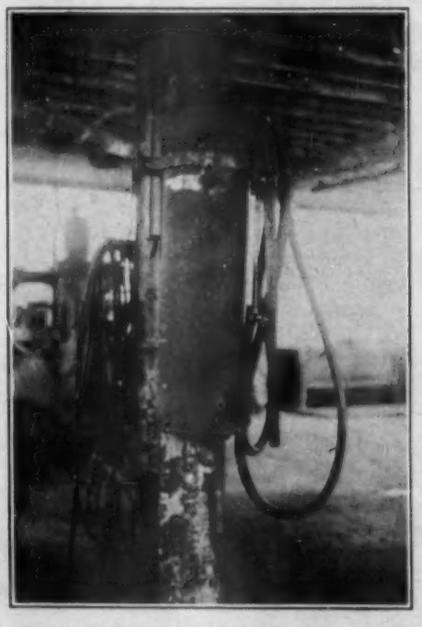
Water Cooling System Reduces Warpage

To minimize warpage, a water cooling system is employed, consisting of an arrangement of drilled pipes in connection with the welding jig. Located under the material being welded, these pipes provide a continuous spray of cold water upon the under side of a joint while it is being welded. This method of cooling is sufficiently effective to permit placing the bare hand on the weld within five inches of the arc.

In addition to all-arc-welded construction, other notable features of these coaches include: four-wheel cast steel trucks with self-contained brakes and journals mounted in roller bearings; elimination of noise by use of rubber in trucks and other parts; installation of unusually wide plate-glass windows; and use of a special material sprayed over internal metal wall surfaces to deaden noise.

Uses Steam to Purge Tanks and for Preheating

A pressing-shop steam boiler, purchased second-hand, is one of the most valuable pieces of equipment that he has, according to Alex Zetzer, one of the proprietors of the Liberty Welding Co., 104 Wayne Ave., Youngstown, Ohio, and it



Small Boiler Insures Ready Supply of Steam for Welding Shop.

is used in the shop for a variety of work. This boiler is approximately 10 in. in diameter and 34 in. long and is mounted in an upright position on a pillar in the shop, with a gas burner underneath, and is connected to a water supply. It is of the tubular type and is equipped with a water gauge.

This boiler will raise steam quickly and, when half full of water, it will supply steam continuously for two and a half hours. With steam so conveniently and cheaply generated, this shop takes no chances on what a vessel might have contained, but steam is turned into all of them before welding or cutting, where it is thought any danger might exist. This is particularly true of automobile gasoline tanks that are brought in for repairing. The steam hose from the boiler is inserted into the gasoline tank for 30 or 40 minutes, and then the tank is welded with absolute safety.

This shop frequently is called on to weld a broken or cracked bracket in Ford Model A cars; this bracket is fastened directly to the gasoline tank (in the front of the car) and braces the steering post. A charge of $5 is made for steaming the tank and welding the bracket. On the other hand, the practice of the Ford service stations is to charge $9 for removing the gasoline tank and bracket, not including the cost of repairs or new parts.

Another application of steam is in preheating complicated gray-iron castings preparatory to brazing. Though the steam will bring the metal up to only about 200° F., according to Mr. Zetzer this temperature is ample if one thoroughly knows how to handle bronze. This method is frequently applied to cylinder heads and blocks where brazing is used.

Welding Classes Formed in Los Angeles Trade School

Two evening classes for the fall term in the Welding Department of the Frank Wiggins Trade School, in Los Angeles, were recently organized with a total enrollment of 56.

A full course of instruction is given, with practical work for training in gas and arc welding. W. P. Fisher is instructor. The classes alternate their sessions between the different evenings of the week.

A new 300-ampere Westinghouse welding unit has been added to the school's electric welding shop equipment, and also two new booths for electric welding add to the convenience and capacity of the department.

Code Covers Construction of Petroleum Vessels

Rules for designing, fabricating, inspecting and repairing unfired pressure vessels for petroleum liquids and gases are given in the new API-ASME Code (1934), publication of which was recently authorized by the American Petroleum Institute and the American Society of Mechanical Engineers. This code was prepared by a special joint committee from both societies, appointed in December, 1931. The preface to the code states that "revisions will be necessary from time to time to keep abreast of developments," and therefore the committee invites constructive suggestions bearing on the code. Suggestions and criticisms should be addressed to R. P. Anderson, 50 West 50th St., New York, N. Y., who is secretary of the code committee.

The present code is divided into five sections, as follows: Section W, Design and Construction of Fusion-Welded Vessels; Section R, Design and Construction of Riveted Vessels; Section I, Inspection, Repair, and Allowable Working Pressures for Vessels in Service; Section S, Material and Other Specifications. Section F, on Design and Construction of Seamless Forged Vessels, is in course of preparation.

Vessels coming within the provisions of this code are limited to metal temperatures of 1000° F. or under, with exceptions made of vessels of certain shapes, sizes and working pressures.

Though in many respects Section W of the API-ASME Code conforms to the ASME Unfired Pressure Vessel Code as it pertains to welded vessels, there are several important differences; one example of which is the permissible use of factors for increasing joint efficiencies where furnace stress-relieving and/or x-raying is employed. The probable construction factors and joint efficiencies for various types of joints, with and without radiographing and/or stress-relieving, and with three different grades of steels, are as follows:

The factor for x-raying is to be employed only when all the main welded joints of the vessel are radiographed. It is also required that all vessels be stressed-relieved when the ratio of the inside diameter to the cube of the shell thickness at any welded joint of a shell or head plate is less than 100, and in addition when there are plates over 1¼ in. thick at any welded joint.

Specifications are given on tension, free-bend, reverse-bend, and nick-break test specimens, and test results must come up to certain minimum standards. All welders are required to have passed such tests before welding on pressure vessels coming under the provisions of the code. Also, it is provided that one test plate from which all test coupons are cut, be made for each type of welded joint used in the main seams of each vessel, except that the number of such plates may be reduced in the case of several like vessels to be constructed. The plates must be of the same material and specifications as those supplied for the vessel, with the same preparation and like welding materials and procedure. The inspector shall designate the welder to weld the test plate.

A hydrostatic test is required for the completed vessel, except in the case of vessels not capable of supporting the weight of liquids, in which case a pneumatic test is specified, during which the pressure is raised in small increments and a lime wash or other brittle material is used to indicate the first signs of distress.

Section I of this code provides for periodic inspection of new and existing vessels and outlines the procedure for making field repairs. The maximum period between inspections is determined by the corrosion rate, which, after the vessel has been in service for a considerable period of time, must be determined by actual measurements.

The information given above is not complete as regards the various topics treated, but is intended only as examples of provisions of the API-ASME Code that differentiate it from previous codes for fusion welding of vessels.

Though the code in its present form is intended only for vessels constructed of carbon steel, the committee recognizes the need for codifying rules for alloy steels and other special materials that have been developed for the most severe service.

Copies of this code are available at $1 each from the American Petroleum Institute, 50 West 50th St., New York, N. Y., and from The American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y.

Description of Joint	Joint Efficiency, Per Cent	Radiograph Factor (1.12)	Stress-Relief Factor (1.06)	Final Joint Efficiency for Groups of Steel, Per Cent A (1.00)	B (0.97)	C (0.92)
Double-welded butt joint and single welded butt joint with backing-up strip	80	..	..	80	78	74
		..	x	85	82	78
		x	..	90	87	..
		x	x	95	92	..
Single-welded butt joint without backing-up strip	70	..	..	70	68	64
		..	x	74	72	68
		x	..	78	76	..
		x	x	83	81	..
Double-full-fillet lap joint and single-full-fillet lap joint with plug welds	65	..	..	65	63	60
		..	x	69	67	63
Single-full-fillet lap joint	55	..	..	55	53	51
		..	x	58	57	54

The crosses (x) in the column headed "Radiograph Factor" and "Stress-Relief Factor" indicate that these operations have been performed. For example, in line 4, the factor under Column A = 80 × 1.12 × 1.06 = 95, and under Column B = 95 × 0.97 = 92.

In the column of "Final Joint Efficiency," Group A refers to steels of A. S. T. M. Specifications A70, A30, and A149 (all firebox grade only) and A150. Group B are steels of A. S. T. M. Specifications A70, A30, and A149 (all flange grade only). Group C are steels of A. S. T. M. Specifications A7, A10, and A113.

Building Up Manganese Steel Pump Shells

In the building up of worn manganese-steel pump shells, it is important that the parent metal be thoroughly cleaned before welding, says Erwin Wiltse, of the Wiltse Welding Co., Saginaw, Mich., who has made many successful repairs of this nature. If the surface of the metal is very dirty, it should be ground off; however, if it is fairly bright, brushing will do. All pits and holes should be cleaned out. Any sand or dirt that remains will cause blow holes and will prevent good adhesion.

Mr. Wiltse usually uses 3/16-in. Hascrome for this work, with reverse polarity, and a current of 175 to 190 amperes, depending on the weight of the casting. The correct amount of heat can best be determined by the operator. A fairly heavy bead, about 3/16 in. thick and ½ in. wide, should be applied, it being woven with a semi-circular motion. Too light a bead will cause blow holes and too heavy a bead will show effects of burning. It is best not to try to get too much penetration, just be sure that the bead is fused in.

To prevent checking, it is best to distribute the heat over as large an area as possible, running a bead about 3 in. long in one spot, then starting another bead farther on. Each 3-in. bead should be peaned with a ball pean hammer as soon as it is laid, to remove strain. The work should be kept cool enough that one can lay his hand on it. Checks will appear if the work is done too fast.

On very thin work, the heat should be cut to as low a point as possible and still get fusion, then proceed very slowly until the metal is built up enough to stand more heat. Castings of 500 lb. or less should be stood in a pan of water in order to dissipate the heat more rapidly and to prevent destroying the temper. This will also help to prevent checking.

Castings that are badly worn on the sides should not be built up, as this will warp the cheeks and the heads won't fit. The warping occurs when the welding is brought up too far on the sides on the inside of the shell.

Civil Service Examination for Metallurgist

An open competitive examination for metallurgist has been announced by the United States Civil Service Commission. The position is in the Ordnance Bureau of the War Department, with headquarters at Rock Island, Ill. Applications must be on file with the Commission at Washington, D. C., by Nov. 8th.

The entrance salary is $3800 a year, with certain deductions. Applicants must have been engaged at least five years in important and responsible physical metallurgical work, including the supervision of and responsibility for the work of others. Postgraduate work in physical metallurgy completed in a college or university of recognized standing may be substituted year for year for the prescribed experience, up to a maximum of three years.

Full information can be obtained from the Secretary of the United States Civil Service Board of Examiners in any post-office of the first or second class or customhouse, or from the U. S. Civil Service Commission, Washington, D. C.

J. C. Lincoln Awarded Miller Memorial Medal

The Samuel Wylie Miller Memorial Medal for the year 1933 has been awarded J. C. Lincoln in recognition of his contributions to the advancement of the science of electric fusion welding. The award, which is made annually and

J. C. LINCOLN

is a most coveted honor, was presented at the fall meeting of the American Welding Society in New York City on Oct. 1st, by J. H. Deppeler, chairman of a committee appointed by the Society to select the recipient of the medal.

Mr. Lincoln is chairman of the board of The Lincoln Electric Co., Cleveland, Ohio. Among the notable contributions which he and his company have made to the advancement of arc welding, are the building of the first variable-voltage arc-welding machine, which was developed in 1907 for the repair of faulty castings by the carbon arc, the development of a shielded-arc electrode, which was first put on the market in 1929, the development of various types of alloy electrodes for various commercial applications, the institution of a school in 1917 in conjunction with the U. S. Government for the training of welders, which school is still continuing in operation and has trained probably in excess of 5000 arc-welding operators, the establishment of the Lincoln arc-welding prizes, which have contributed immeasurably to the literature on the art, aid in expanding the use of arc welding to nearly all civilized countries and to innumerable types of equipment and structures, and the development of the only commercially successful automatic welding device utilizing the carbon arc.

Steel Warehouse Association Expands Its Services

The American Steel Warehouse Association, Inc., whose offices were formerly in Philadelphia, recently moved to 442 Terminal Tower, Cleveland, Ohio, reorganized and have started expansion of the Association's services which it is hoped will be more commensurate with the growing importance of the steel warehouse as a connecting link in the distribution of steel mill products. This announcement was made by H. B. Ressler, who is president of the Association and Vice-President of Eastern Operations of Joseph T. Ryerson & Son, Inc.

This explanation of the purpose of the Association is expanded in Section 2 of their constitution, dated October 2, 1934, as follows:

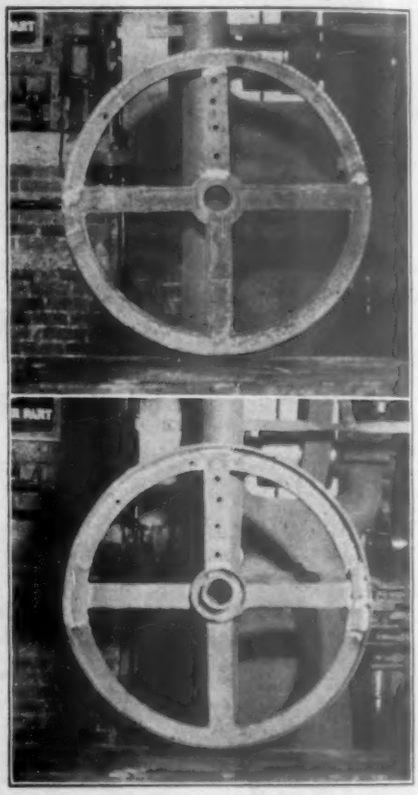
"The purpose of the Association shall be, in all ways which are lawful and consistent with the public interest, to advance the interests of the steel warehousing industry, by promoting the distribution of iron and steel products through persons engaged in the industry, by reforming abuses in the industry, by collecting and disseminating useful statistics and information, by encouraging enlarged and more friendly intercouse between persons engaged in the industry, by fostering improvements in the service rendered by the industry to consumers of iron and steel products, by promoting reduction of costs, by promoting improvement of quality in, expansion of markets for, and development of new uses for, iron and steel products, and by assisting in the maintenance of sound and equitable relations between the industry and its employees, its customers, the general public and the Government."

W. S. Doxey, formerly editor of *Daily Metal Trades,* has been appointed executive secretary.

This association is also acting as agent for the Subdivisional Authority under the General Wholesale Code for the distribution of iron, steel and alloy products.

Half of Casting Missing—Shop Repairs It

When a farmer brought a gray-iron casting from a land roller into the shop of the Lapeer Welding Works, Lapeer, Mich., to have it repaired, H. A. Ross, proprietor of the shop, undertook the



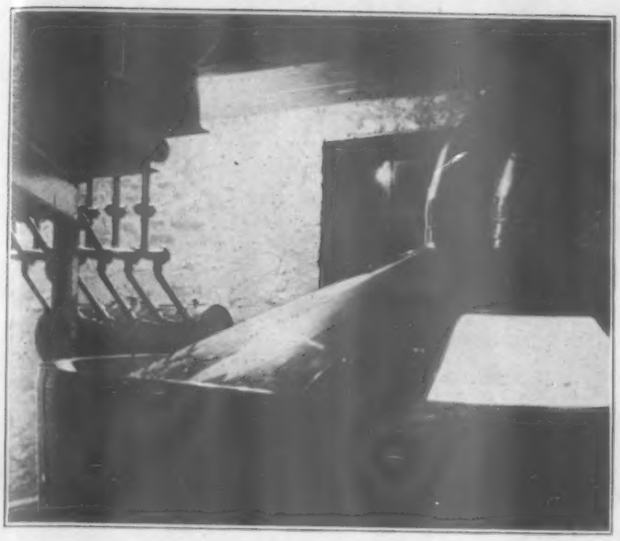
Showing Both Sides of Gray-Iron Casting After Being Repaired.

job, even though almost half of the casting had broken off and was lost. The casting, as shown in the illustration, was shaped like a wheel, with four spokes and hub.

Using 1½x¼-in. strip stock, Mr. Ross shaped the rim, and from the same stock he shaped a piece for the side of the rim, both pieces to replace the upper half of the casting. A piece of 1½x⅜-in. scrap was used for the missing spoke. These parts were set in place and tacked, then tested for trueness, after which they were welded with the arc, the white lines in the illustrations showing the welds. Reinforcing straps were used on one side of the casting, where the steel rim joined the cast-iron section.

Though a piece of this kind is ordinarily not repaired but is replaced by a new one, the customer in this case asked for a repair job, and Mr. Ross displayed enough ingenuity to be able to satisfy the customer's wishes.

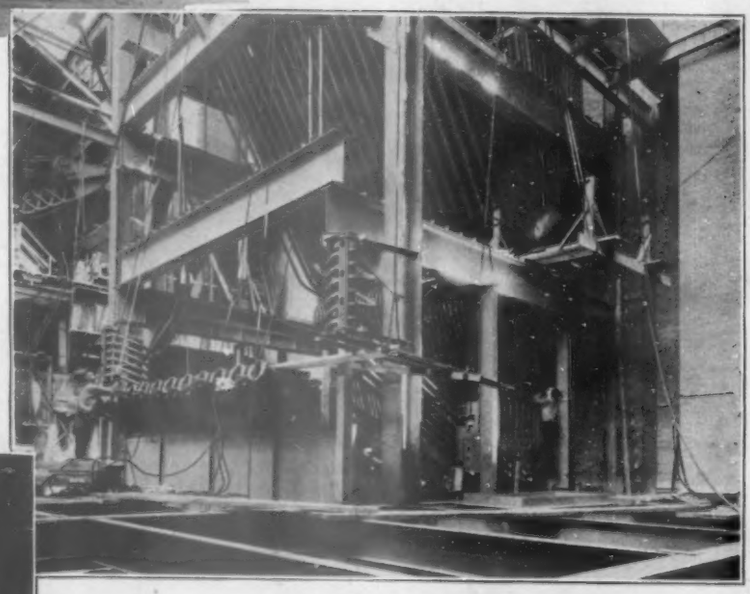
WELDING NEWS ▪ IN PICTURES



• Gleaming like lustrous silver, this brew kettle, of welded stainless steel, adds a note of spotless cleanliness to the plant of the Weber-Waukesha Brewing Co., Waukesha, Wis. Kettle fabricated by the Cream City Boiler Co., of Milwaukee.

• Welding the stator of a generator for Boulder Dam, in the plant of the General Electric Co., at Schenectady, N. Y. Almost a mile of welding is required in one generator frame.

• The all-welded semi-trailer is strong and durable. No bolts or rivets to work loose. Made by George Welding Co., Akron, Ohio.



• Boilers and stokers in the new Westinghouse steam plant at East Pittsburgh, are supported by welded steel framework.

• Steel gear made by welding weighs 10% less than cast gear. Fabricated by Walter J. Thomas & Co., Detroit.

New Equipment

"Volt-Amp Adjuster" for Remote Control

A "Volt-Amp Adjuster" which can be taken from the machine to the work when remote control is desired, is now furnished as standard equipment on all Hobart arc welders. This new device is

New Adjuster Allows Sensitive Control of Welding Volts and Amperes.

characterized by the many possible voltage-current combinations it allows. More than 140 steps are available, which means that the welder can obtain more than 140 combinations of voltage and welding current without going near the machine. At the machine itself, 430 different combinations are said to be available. Advantages claimed are close control and great flexibility in all kinds of work.

Protection for Chipping and Welding in One Goggle

Eye protection for chipping and welding is now available in one goggle, this being the new style DC50 goggle, developed by Willson Products, Inc., Reading, Pa. This is an anatomically shaped composition cup goggle with 50-mm. clear Super-Tough lenses next the eye and 50-mm. Willson Weld lenses and clear cover lenses in a hinged frame. The goggle is used open for chipping and closed for welding. This goggle saves the workman the trouble of laying down his tools to change goggles. As a result, there is not the temptation to go without proper eye protection as there is when goggles must be removed each time a change is made. The DC50 goggle does not interfere with the wearing of spectacles.

Portable Grinder Has Air Filter

A new portable electric grinder of the universal type, with a built-in air filter,

Dust Cannot Enter the Motor Windings of This Compact, Light-Weight Grinding Tool.

has been announced by the Chicago Wheel & Manufacturing Co., 1101 W. Monroe St., Chicago, Ill.

This tool weighs 4 lb., turns up 17,000 r.p.m., and is said to have ample power to pull a wheel 2 in. in diameter. The motor housing, of heavy cast aluminum, extends out over the motor shaft and air filter, and is encased with an insulating cushion grip, giving positive control and operating flexibility.

The tool is compact, well balanced, and, with a suitable grinding wheel or cutter inserted in the universal case-hardened chuck, will work at any angle and get into and around corners, irregular-shaped holes and other hard-to-reach places.

The filter is of the viscous type and is easily removed for cleaning and re-oiling. It is claimed to be very effective in keeping all dust and abrasive matter out of the motor and bearings and, even when loaded with foreign matter, it is said not to impair the ventilation of the motor.

Offers Line of Lighters and Igniters

A complete line of lighters and igniters for natural and artificial fuel gases has been placed on the market by the Starlite Metal Products Co., 70 Grand St., New York, N. Y. Included in the line are Circofile, a round file lighter; Everlite, a flat file low-priced lighter; and the Bensun Ignitor. Renewal tips are supplied for all these types.

The Bensun Ignitor is intended for attachment to any gas appliance. It is of the clamp type, is valveless and is readily attached to any burner by removing the clamping screws. It can then be squeezed onto the narrowest part of the burner and then pushed down over the larger portion of the burner. It is easily attached to acetylene and gas burners.

The Bensun Ignitor is provided with a 5-in. long stem, of spring flat wire. The round file at the top is made of glass hard steel and will last for many years. Flint tips are easily renewed, and the construction is such as to make full use of the flint. To light, it is only necessary to turn the flat disk at the bottom. The Ignitor is simple in design and easily repaired in the event of any part loosening.

With the Welding Lenses Raised, the Eyes Are Protected Against Flying Chips and Other Particles.

With the Welding Lenses Lowered, the Eyes Are Protected Against Dangerous Light Rays and Glare.

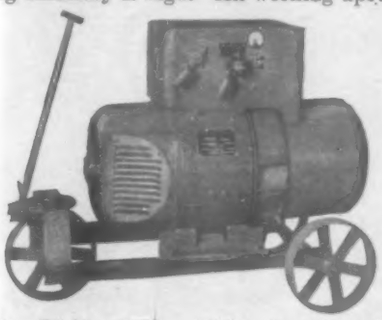
New Line of Portable Arc-Welding Sets

Self-stabilization is the outstanding feature of a new line of portable, single-operator arc-welding sets, known as the WD-30 line, offered by the General Electric Co., Schenectady, N. Y. These sets are said to give excellent performance throughout the entire welding range, with any type of electrodes, whether bare, lightly fluxed, or heavily coated.

Each welder is a self-contained unit, having no external reactor, resistor, or separate exciter. The self-stabilization is said to make the welding arc "peppy"

and stable at all times. Separate controls allow for adjustment of welding current and voltage.

It is also claimed that commutation is excellent at all current values and operating efficiency is high. All working aprts



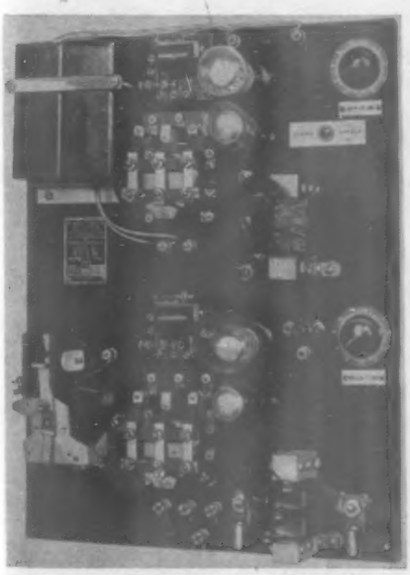
New Welder Design Makes for Compactness and Electrical Stability.

are thoroughly protected against damage from water or other foreign materials by completely drip-proof construction.

The entire set is low-hung on a 3-wheeled truck, providing a high degree of portability and mechanical stability, without sacrificing road clearance. The set may safely be tipped as much as 22° from the vertical, it is claimed.

Weld Timer Adjustable for "Off Time" Period

A new automatic timing device for resistance welding machines gives a definite "off time" period, during which the electrodes are separated so the work can be shifted, and in addition it automatically provides a welding period which is



Control Panel of Automatic Repeat Weld Timer.

in inverse proportion to the rate of current flow, insuring that a definite, correct number of heat units are put into each weld. This device, known as the EC&M Automatic Repeat Weld Timer, is a product of The Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland, Ohio.

This control employs two separate electric circuits, easily adjustable and independent of each other. It makes it possible to start in a "green" operator with the proper time interval to allow for shifting the work; and as the operator becomes more expert, the "off time" can be gradually shortened up in almost perceptible steps to compensate for the increasing efficiency of the operator.

In a certain automobile plant, a bar welder, which is a form of portable spot welder, equipped with one of these timers, has the "off time" so adjusted that by applying pressure sideways to the welder, it will skip along from one spot position to the next, giving just the right distance between welds.

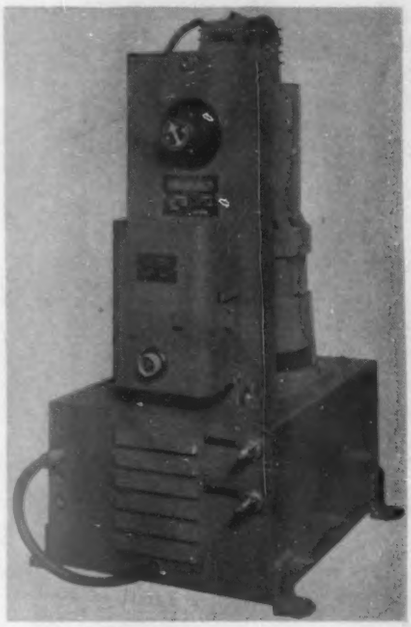
A small double-throw snap switch on the timer panel permits the timer to be set for automatic repeat operation or to provide single-shot operation for trial welds and similar temporary operation in which only one weld at a time is desired.

75-Ampere Welder for Light-Gauge Work

An arc welder for sheets, plates and shapes of thin sections has been announced by The Lincoln Electric Co., Cleveland, Ohio. This welder, known as SA75, has a NEMA rating of 75 amperes and employs a 25-volt arc. It will deliver as low as 20 amperes at the arc and as high as 100 amperes, it is claimed, without the use of auxiliary devices. This welder is a motor-generator unit, supplied for 110 and 550 volt alternating current, or special voltages; one, two or three phases. Connections are also readily available for 220 or 440 volts. A dual control provides independent adjustment of open-circuit voltage and welding current.

The unit requires less than 2¼ sq. ft. of floor space. It is 20 in. long, 16 in. wide, and 40 in. high. Arc-welded steel is used to a great extent in its construction. The unit can be arranged to be moved on two small wheels mounted on the base, and is completely wired ready for operation when connected to the power line.

Since it supplies a uniform current of proper characteristics for using electrodes as small as 1/16 in., this new



New Welder Will Deliver as Low as 20 Amperes.

welder can be employed by metal-working shops and industrial plants on materials as light as 24 gauge. The manufacturer recommends it for the making of fender and body repairs, and for repairing bumpers, frames and other heavier materials, including cracked water jackets and cylinder heads.

Trade Literature

"Electric Welding of Pipe Lines—the Modern Method" is the title of a 20-page booklet isued by H. C. Price, Inc., Bartlesville, Okla., describing the company's service in the construction of electrically welded pipelines, and pointing out the advantages in quality, speed, economy and permanency in this type of construction. A listing is given of the pipelines are welded by this company, ranging in size from 6 to 26 in., and totaling 3443 miles and 421,700 welds. The booklet contains a number of interesting field views.

A test was recently made on a specimen consisting of two beams welded to a section of column, with full-size connections, so designed as to obtain beam continuity, and the results are reported in Plate 46 in the series of "Studies in Structural Arc Welding," issued by The Lincoln Electric Co., Cleveland Ohio. Within the elastic limit, the observed deflections were close to the calculated figures. One of the beam flanges buckled before any failure in the welds occurred.

The new Wilson No. 97 heavy-coated steel electrode for cast-iron welding, flows quietly and smoothly, produces both a protecting atmosphere and a slag

covering that insures strong fusion and eliminates porosity, and makes it possible to secure deep penetration with low heat, according to a folder issued by the Wilson Welder & Metals Co., Inc., North Bergen, N. J. Stocks of this electrode are carried in the Chicago and Detroit warehouses of the Steel Sales Corp.

The many kinds of jobs that can be done with the 40-volt carbon arc are described in a book on "Carbon Arc Welding," just issued by Hobart Brothers, Box U-104, Troy, Ohio. Applications include the welding of copper, bronze, cast iron, and galvanized steel, as well as hard-surfacing, cutting of metals, and "etching."

"Thumbs Down on Rust" is the title of a folder issued by the Republic Steel Corp., Massillon, Ohio, outlining the advantages of Toncan Iron where long life and resistance to rust and corrosion are desired. A number of typical installations are shown. Copies may be obtained by asking for Bulletin No. Adv. 132.

"Keraflux" is described as an all-purpose welding and brazing flux for cast iron, steel, copper, brass and bronze, in a folder recently issued by The Keratherm Co., 5511 Euclid Ave., Cleveland, Ohio. Welds produced with this flux have desirable physical characteristics, it is stated.

The "Roffy Automatic Arc Torch," for welding, soldering, and brazing, with a transformer for supplying low-voltage current to the carbon electrodes, is described in a folder recently issued by the Electric Torch Mfg. Co., 2442 San Pablo Ave., Oakland, Calif.

"Silicate P's and Q's" is the title of a leaflet discussing the use of silicates of soda in coatings for welding electrodes and rods. This leaflet is published by the Philadelphia Quartz Co., 121 S. Third St., Philadelphia, Pa.

Welder Specification Bulletin No. 304 lists the general specifications for engine-driven Type SA300 Lincoln "Shield-Arc" welders. Copies of this bulletin may be obtained from The Lincoln Electric Co., Cleveland, Ohio.

A catalog of pilot lighters and automatic igniters for natural and artificial gases has been issued by the Starlite Metal Products Co., Inc., 70 Grand St., New York, N. Y.

Commercial News

In addition to the list of distributors of "Sight Feed" acetylene generators given in the September issue of *The Welding Engineer*, the following jobbers have recently been added in the Southwest, according to the Sight Feed Generator Co., Richmond, Ind.: Hargett Electric Co., Dallas, Texas; General Battery & Electric Co., Dallas, Texas; East Texas Auto Supply Co., Kilgore, Texas; Conner Mathes Co., Plainview, Texas; Wadel Connaly Co., Tyler and Longview, Texas; Severin Tire & Supply Co., Oklahoma City, Okla.; Gabert Auto Parts & Service Co., Ft. Worth, Texas; Well Machinery & Supply Co., Ft. Worth, Texas; Strange Jones Hardware Co., Clinton, Texas; and Lanman Supply Co., El Reno, Okla.

The Cleveland School of Welding, Cleveland, Ohio, recently made an adjustment in the length of their courses in oxyacetylene and electric welding, which were formerly set up on the basis of 80 hours minimum. E. T. Scott, president, announces that this has been lengthened to 140 hours minimum for either course. This will lengthen the day course to 6 weeks minimum and the night course, meeting three nights a week, will take a minimum of 4 months. No increase in rates have been announced.

Completion of plans for the holding of a 4-day welding clinic in New Orleans, La., starting Oct. 24th, has been announced by The Linde Air Products Co., 205 East 42nd St., New York, N. Y. This will be the fourth clinic of this type sponsored by this company this year, the others having been held at Birmingham, Ala., Houston, Texas, and Cleveland, Ohio. The New Orleans clinic will be held at the Isaac Delgado Central Trades School.

Claude A. Steadman has become associated with the Pioneer Engineering & Mfg. Co., 8316 Woodward Ave., Detroit, Mich. He formerly served various motor companies as tool and die engineer and was later with the Taft Pierce Mfg. Co., Woonsocket, R. I. For the last five years he was chief tool designer for the Wright Aeronautical Corp. at Paterson, N. J.

A contract for oxygen and calcium carbide has been awarded The Linde Air Products Co. by the Mason-Walsh-Atkinson-Kier Co., contractors for Grand Coulee Dam, near Spokane, Wash. The contract, it is estimated, will be between $50,000 and $75,000. Considerable cutting and welding will be necessary for the monster dam and allied projects.

Don Llewellyn, of the Applied Engineering Department, Air Reduction Sales Co., recently won first prize in *Roto*, a national pictorial magazine, for a photograph which he entered in a recent contest. The picture was one taken on the Pacific coast from a cliff looking down through pine trees into the ocean 300 ft. below.

Joseph W. Meadowcroft, whose association with the Edward G. Budd Manufacturing Co., of Philadelphia, dates back to the founding of the company, recently returned from an extended stay in France in connection with production problems in the plant of the Citreon Motor Car Co.

Charles Cooper & Co., California distributors of Hobart arc welders, announces a change of address for their Los Angeles offices. The new location is 1580 E. Slauson Ave. The former address was in the Delta Building, at 426 S. Spring St.

Calvin W. Rice, secretary of the American Society of Mechanical Engineers, died in New York City on Oct. 2nd at the age of 65 years. He was one time identified with the General Electric Co. and with several utility companies.

The Allsteel Press Co., 12015 S. Peoria St., Chicago, Ill., have appointed the Mechanical Equipment Sales Co., 416 Chamber of Commerce Bldg., Cincinnati, Ohio, as their exclusive representatives in the Cincinnati district.

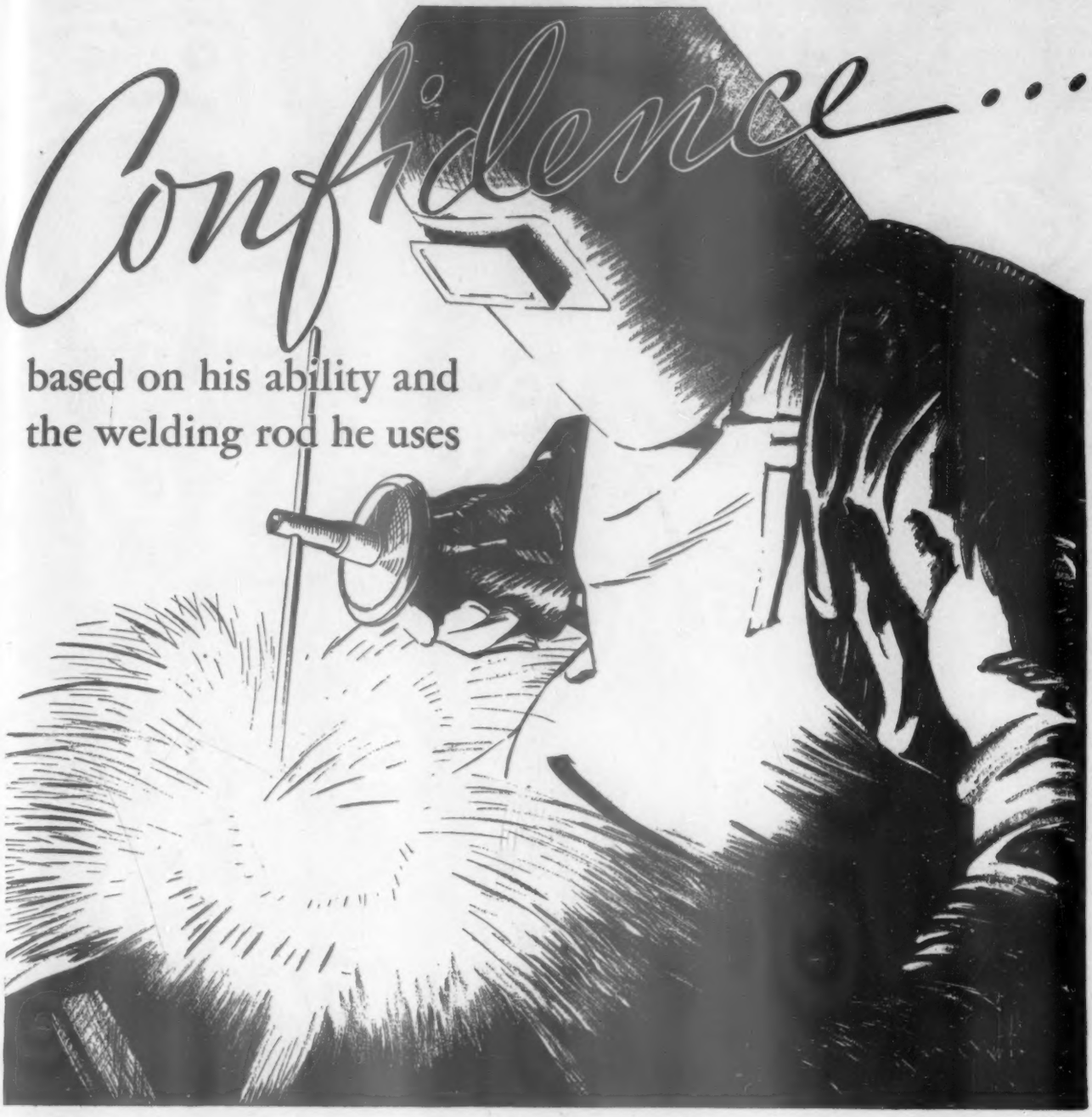
The Victor Welding Equipment Co. has moved its Los Angeles office across the street from the old location into new and larger quarters. The new address is 2037 S. Santa Fe Ave.

A Grand Rapids, Mich., office has been opened by Revere Copper and Brass Incorporated, at 922-23 Grand Rapids National Bank Building. David T. Applebee is district manager.

Wilber E. Goodhart, 127 W. Orange St., Shippensburg, Pa., was recently appointed a representative for Hobart Brothers.

Confidence . . .

based on his ability and the welding rod he uses



MORE than a century of metallurgical experience accounts for the uniform composition and unvarying high quality of Anaconda Welding Rods.

Because they can depend on Anaconda Rods for uniformly good results, thousands of welders prefer them to other brands.

Fourteen standard Anaconda Welding Rods for gas or electric welding purposes are listed at the right. All are available through leading distributors. Usually shipped in bulk, but also obtainable in clearly labeled 10-lb. packages. Our new publication B-13, mailed on request.

MELTING POINTS OF ANACONDA WELDING RODS

Material	Approximate Melting Point—Degrees	
	Cent.	Fahr.
Tobin Bronze	885	1625
Manganese Bronze	870	1598
Brazing Metal	930	1706
Naval Bronze	885	1625
Everdur	1019	1866
Phosphor Bronze A	1050	1922
Phosphor Bronze E	1070	1958
Phosphor Bronze D	1000	1830
Phosphor Bronze C	1025	1877
Silicon Copper	1083	1981
Deoxidized Copper	1083	1981
Electrolytic Copper	1083	1981
Nickel Silver	1055	1931
Ambrac	1150	2102

ANACONDA
from mine to consumer

THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Connecticut

Offices and Agencies in Principal Cities

In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

ANACONDA WELDING RODS

Notes From the Field

A very large cutting contract was recently placed with the Newman Iron & Steel Co., Cleveland, Ohio, and work started, involving the cutting up of the steamship *Hamburg*, which was formerly a German tank boat and more recently owned by the Armour & Co., who used it for shipping lard. The *Hamburg* is a 15-ton boat. The oxygen cutting torch is being used to dismantle the boat into large sections which can be handled by a crank and later are to be sheared into charging-box size. It is estimated that three months will be needed to complete this contract.

The Hub City Welding Works, of Colton, Calif., formerly located on Eighth St., recently moved into a newly constructed shop building located at 830 East "F" St. The frame of the new structure, 65 by 35 ft., is built entirely of old car frames and old bed frames, and is, of course, all-welded. Herschel Hunt, proprietor, does a general job welding business, specializing in welded-car-trailer building.

H. C. Price, Inc., of Bartlesville, Okla., have been awarded the contract for electric welding approximately 70 miles of the Standard Oil Co.'s (of California) new 20-in. oil line which is to extend from the oil company's wells in the San Joaquin valley to the company's marine loading terminal at Estero Bay. The section contracted is the west end of the line. Work is already under way on the project.

Forty-eight thousand feet of electric welding, which will be mainly on plate work, is involved in the Southerly Disposal Plant for sewage disposal, which is to be completed in Cleveland, Ohio. The bulk of welding on plate work is in connection with vats, dryers and canals, which are of all-welded construction. Hunkin-Conkey, who are the engineer contractors, are subletting the steel and welding contracts.

S. ("Tex") Hensley, well known in Southern California welding circles, after an absence of four years is back with the National Electric Welding Corp., at 2777 E. Slauson Ave., in Huntington Park. Mr. Hensley has for the past several months been associated with the Griffith Co., Los Angeles contractors.

The W & T Welding Co., of Huntington Beach, Calif., has been awarded the contract by the Holly Refining Co., for the welding of a $100,000 oil pipe line for the Huntington Beach oil field. The contract for welding was let on a footage basis.

The Metal Engineer and Welding, Inc., 4623 North 15th St., Philadelphia, Pa., George Fisher, proprietor, recently received a contract for installing an ammonia line. This involves the welding of pipe 6 in. down to ¼ in. in size and includes all outlet connections, etc.

Wm. Heald, blacksmith and welding shop operator of LaPorte, Ind., died recently. His shop has been purchased from his heirs by Alvin Costello, who formerly worked for Mr. Heald.

Ward Hobbie has leased the Weber building at Elma, Iowa, and will open a welding and machine shop.

· CLASSIFIED ADS ·

Help Wanted—75c per line, minimum 4 lines. Jobs Wanted—4 lines free. Other Ads—$1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

FOR SALE

Bargain—One five-operator G-E 800-amp. Welder, a.c. motor drive. A-1 condition. Also all makes and sizes of used arc welders for sale or rent. Guaranteed. Service Co., 3741 Cedar Ave., Cleveland, Ohio.

Bargains—Demonstrator Arc Welders. Gasoline, electric drive, belted, or coupled-together outfits. 30 days' trial. Easy terms, if desired. Write Ken's Welding Exchange, Box U-1041, Troy, Ohio.

Fly Ball Governors—Adapted to all makes of auto engines; belt driven, flat or V. Price, $6.50 prepaid. Satisfaction guaranteed. In ordering state style of belt. Wm. D. Alber, Beatrice, Nebr.

For Sale—Lincoln 200-Ampere Portable Welder, rebuilt completely. For operation on 100 volts d.c. power. Price only $200.00. Welding Engineering Co., Milwaukee, Wis.

POSITIONS WANTED

Designer and Welder—Experienced in arc welding and in the designing of steel structures. Has had drafting-room experience. Well versed in both theory and practice. Formerly with steel-fabricating company. References. Address O-2, The Welding Engineer.

POSITIONS WANTED

Gas Welder and Mechanic—14 years' experience. Can weld all common metals. Desires better job with better future. Highest recomemndations. W. D. Morris, Box 425, Heber Springs, Ark.

Arc-Welder—Ten years with large automobile manufacturer and two years with welding contractors. Married, 33 years old. D. Mencotti, 15368 Fairfield, Detroit, Mich.

Layer-Out and Welder—Full-fledged layer-out and certified electric welder with 9 years practical welding experience. Address O-1, The Welding Engineer.

Combination Welder—Wide experience in gas and arc welding. Has good record as supervisor. Address O-4, The Welding Engineer.

BUSINESS OPPORTUNITIES

WELDER OPERATORS!!

Send 25c in stamps to get full details showing how you can make up to $25.00 per month extra with very little effort. Address O-3, The Welding Engineer.

Agents and Jobbers Wanted—For new scientific all-purpose welding and brazing flux. The Keratherm Co., 5511 Euclid Ave., Cleveland, Ohio.